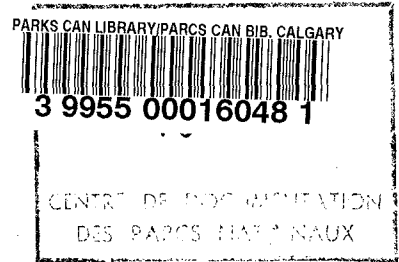


(30)
QE 359
.C3
H81
(5)
C.4



NATURAL HISTORY STUDY
OF MINERAL AND THERMAL
SPRINGS IN CANADA

LIBRARY / BIBLIOTHÈQUE
CANADIAN HERITAGE / PATRIMOINE CANADIEN
551, 220 - 4th AVENUE S.E.
CALGARY, ALBERTA T2P 3H8

Prepared by

Stephan J. Houseknecht
TERA Environmental
Consultants Ltd.
Vancouver, B.C.

Prepared for

Parks Canada

January, 1984

LIBRARY
PARKS CANADA
W.R.O.

BIBLIOTHEQUE
PARCS CANADA
B.R.O.

Feb 036/92

tera

LIST OF TABLES

- Table 301** General Physical and Biological Characteristics Identified for each Spring
- Table 5-1** Number of Thermal and Mineral Springs by Region
- Table 6-1** Thermal Spring Assessment
- Table 6-2** Mineral Spring Assessment
- Table 7-1** Ranking of the Top Thermal Springs found in Canada
- Table 7-2** Ranking of the Top Mineral Springs Found in Canada
- Table 8-1** Thermal and Mineral Springs Found Within Canadian National Parks

1.0 INTRODUCTION

On August 23, 1983, Parks Canada awarded TERA Environmental Consultants Ltd. a contract entitled "Natural History Theme Study of Mineral and Thermal Springs in Canada". The objectives of this study are to describe the origins of mineral and thermal springs*; inventory the known mineral and thermal springs in Canada considering biotic and abiotic characteristics, human use, access, and historical features; and develop assessment criteria to evaluate and rank the mineral and thermal springs. This information will be used to identify "Natural Sites of Canadian Significance".

1.1 Background

Mineral and thermal springs* have long been recognized for their reputed therapeutic value. The development of these springs for bathing (thermal springs) and bottled water (mineral springs) has been an important use over the decades. Recently their use for producing geothermal power has been investigated (Souther and Halstead, 1973). These factors have resulted in the development of many springs into health spas or bottled water facilities. However, because of poor access, many springs still retain their natural characteristics. Because of the warm waters and high mineralization, mineral and thermal springs, in their natural state, generally have unique physical and biological characteristics much different from the surrounding environments. This uniqueness and contrast to local environments causes a keen public interest in mineral and thermal springs. Consequently, the protection of exceptional examples of mineral and thermal springs is an important objective due to increasing development pressure. Protection of exceptional examples of mineral and thermal springs would be achieved through the "Natural Sites of Canadian Significance" program, of which this natural history theme

*Springs are considered mineral if their total dissolved solids exceed 1000 ppm; and thermal if their temperature is more than 5°C above the mean annual air temperature.

study will form a part. Under this program a mineral and/or thermal spring could become a Canadian Landmark following a prescribed review process.

1.2 Previous Work

The investigation of mineral and thermal springs in western Canada began as early as 1912 with an investigation of the Roche-Miette area of Jasper National Park (Dowling, 1912). The mineral waters of Quebec were first investigated around 1850 by the Geological Survey of Canada (Paquet, 1964). The late 1800's and early 1900's also saw the production of salt from brine springs in the Appalachian region of Canada (Cole, 1930). Interest was high in the period between 1916 and 1926 with many researchers investigating springs throughout Canada. The majority of the emphasis was on the physical water characteristics. Little work was done on the biological aspects. This reflected the interest in the development of spas and "bottled water" facilities. During the period between 1930 and 1962, the majority of mineral springs were developed for bottled water facilities (Paquet, 1964).

Following this period of activity, scattered studies on mineral and thermal springs took place (Atchison, 1964; Brandon, 1965; Haites, 1959; Waring, 1965). However, not until 1973 did any up-to-date compilation of mineral and thermal spring literature take place (Souther and Halstead, 1973). Recent literature has been aimed at geothermal investigations and recreation studies of thermal springs (Van Everdingen, 1972 and 1973; Marsh and Scotter, 1975 and 1976; Crandall and Sadlier-Brown, 1976; McDonald et al, 1978; and B.C. Hydro, 1980).

While these reports addressed topics such as water quality and quantity, geothermal potential, and overall recreational possibilities, a minimal amount of effort was expended on the biological characteristics. Probably the most complete works on the biological characteristics were conducted on thermal springs in the Liard River basin of British Columbia and the southern Yukon. Porsild and Crum (1961) were the first to study the Liard River Hotsprings in detail. Following their study, numerous

others have surveyed the biological characteristics of the Liard River Hotsprings (Pavlick, 1974; Reid, 1974, 1975 and 1976; and Clarke, 1977). The other thermal springs in the Liard Basin have also been the subject of biological investigations. These include: Annas, 1974 (Toad River hotsprings); Dennington, 1975 (Coal River hotsprings); B.C. Hydro, 1980 and Ceska, 1980 (14 hotsprings in the Liard Basin); and Scotter and Cody 1979 (Beaver River and Larson Creek hotsprings).

Nahanni National Park and Banff National Park are the only other known areas where biological investigations of thermal springs have taken place. Marsh and Scotter (1975, 1976) classified the vegetation surrounding the Nahanni River and Rabbitkettle Hotsprings; while numerous investigators have studied those in Banff National Park (Marsh, 1974; Nelson, 1982; Reynolds, 1976).

2.0 STUDY LIMITATIONS

The geographic coverage of published information on mineral and thermal springs is uneven. Some springs, especially those of commercial value, have been studied in detail, while other springs have received only cursory investigations. In addition, springs found in the east lack any substantial data on their general physical character or natural significance. The chemical characteristics of waters is generally the only information available. However, since most have been developed commercially, the direct need for this data is lessened because of the severe human impacts affecting the natural springs environment.

The greatest concern is the overall lack of biological data, causing difficulties in comparing the various spring types for the ranking. It is possible that certain springs will receive a higher rating because of a more complete data base. In order to counteract this potential problem, it is hoped that the experience of the author and discussions with persons who have been to the springs in question can "bridge the gap" and provide a consistent ranking.

Where springs are rated high in the ranking system, but the data base is suspect, field studies should be conducted to confirm the spring's significance. This will ensure a consistent and accurate ranking and identification of Natural Sites of Canadian Significance.

This study focuses on known thermal and mineral springs in Canada. Throughout the conduct of the study, it became evident that more thermal springs probably exist that have yet to be recorded. The vastness of the Cordilleran region and lack of access leads to this conclusion. Many unsubstantiated sightings by helicopter pilots and prospectors were uncovered by the author and people contacted. Since no data could be ascertained or a specific location, these were generally disregarded. It is reasonable to assume that all the significant springs have been discovered and sightings made are probably small, relatively insignificant springs. In addition, probably more mineral springs are yet to be recorded because there is less interest in mineral springs and they are more difficult to detect in dense bush, e.g. no characteristic steam venting.

3.0 STUDY METHODS

3.1 Inventory

The study relied on existing data to assess and rank the known mineral and thermal springs in Canada. A detailed literature review, personal knowledge and discussions with persons knowledgeable in mineral and thermal springs was used to inventory, assess and rank the known mineral and thermal springs. A list of persons contacted is contained in Appendix C.

The inventory information derived from the above sources was regionalized and a standardized set of physical and biological parameters defined. These are shown in Table 3-1. The physiographic regions were used to divide Canada into areas of similar geology and structure. The geology and structure control the circulation of groundwater and this is important in the development of springs. For example, all known thermal springs in Canada occur in the Cordilleran Region where high topographic relief permits deep circulation of meteoric water, while most mineral springs are associated with marine sedimentary rocks in the Appalachian and St. Lawrence Regions.

3.2 Assessment

In order to evaluate each thermal and mineral spring, a qualitative rating scheme was developed to establish the relative importance of the known springs in Canada. Mineral and thermal springs were rated and ranked separately since they obviously possess different abiotic and biotic characteristics owing to water temperature and water quality differences.

The assessment is designed to determine the relative significance of each spring by comparing its natural attributes with the other springs found in Canada. This process will identify those natural attributes which are significant examples of thermal spring phenomena and allow each spring to

TABLE 3-1. General, Physical and Biological Characteristics identified for each Spring.

<u>General</u>	Location Ownership Access Human impact General description
<u>Physical</u>	Temperature Volume Total Dissolved Solids Chemical Constituents Gaseous Constituents pH General character of water Exceptional Features
<u>Biological</u>	Flora Fauna Exceptional Features

be ranked and the best examples that are considered of national significance identified.

The rating scheme was developed in concert with Dr. J. Souther of the Geological Survey of Canada, Vancouver, who is an acknowledged authority on thermal and mineral springs in Canada. Discussion with Dr. Souther and the results of the inventory identified eleven (11) significant abiotic and biotic features that either are unique to mineral and thermal spring environments or generally characterize spring environments.

These 11 features are listed and briefly described below:

1. Examples of travertine deposits - Travertine or tufa deposits are characteristic formations that build up around spring outlets where the waters are high in calcium (carbonate or sulphate). Spectacular terraced cliffs can be formed that are unique features of thermal and mineral springs.
2. Relative spring temperatures - water temperature 5°C above the mean annual temperature is considered thermally influenced. The higher the water temperature the more attractive the spring is recreationally and its biotic attributes are generally greater.
3. Relative volume of discharge - the higher the volume of water discharged, the more significant the spring can be in other abiotic and biotic characteristics.
4. Relative number of spring vents or pools - this is a method of estimating the area the spring affects or has altered.
5. Overall water quality - the water quality criterion provides an estimate of the character of the water for recreational bathing or in the case of mineral springs, drinking.
6. Examples of cascading waterfalls - many springs possess small waterfalls especially where terraced travertine deposits have built

up. These generally enhance the visual features of the springs.

7. Floristic Diversity - this is an estimate of the richness of the flora and the equitability with which the individual plants are distributed into different species.
8. Vegetation communities diversity - this is a measure of number of micro-habitats and indicates the complexity of the vegetation communities present.
9. Presence of rare or unique plants or animals - the environments around mineral and thermal springs, because of the warm waters and high mineral content, provide unique habitats for specialized plant and animal species only found near thermal and mineral spring environments.
10. Important wildlife habitat - the environments surrounding mineral and thermal springs also can provide valuable habitat especially during winter months. The high mineral content of the water and its deposits can be used as a mineral lick, while the area around thermal springs can remain green throughout the winter and provide winter feed and habitat.
11. Degree of naturalness - this is an estimate of the modification by man and the ability to reverse damage caused by man-made activities.

These 11 features were rated on a 0-5 scale with 5 representing the most significant or outstanding and 0 meaning no representation. Where no data on a feature was available, it was indicated. Once each spring was rated for its individual features, they were totalled to determine the thermal and mineral springs with the highest score and therefore exhibit the greatest number of characteristic and unique features. In addition, those springs which have outstanding examples of special spring features such as large, terraced travertine formations were highlighted. The most outstanding thermal and mineral springs were then discussed and recommendations made concerning thermal and mineral springs that should be considered as Natural Sites of Canadian Significance.

Mineral and thermal springs found in existing national parks were also compared with springs determined to be outstanding in the previous assessment. This indicates how well the springs in existing national parks are representative of mineral and thermal features found in Canada.

4.0 ORIGIN AND CHARACTERISTICS OF THERMAL AND MINERAL SPRINGS

4.1 Origin

The distribution and mineral character of thermal and mineral springs are correlated to the regional physiography. The various rock types and structures control the circulation of ground water, and therefore influence the temperature and water chemistry of the springs (Souther and Halstead, 1973). Issuance of spring waters at the surface is related to topography and geologic rock type with the location of joints and fractures in the underlying bedrock the main controlling factor.

Thermal springs in Canada generally occur in areas of high topographic relief that have been faulted and/or folded in recent geologic time (Tertiary). This permits deep circulation of meteoric waters that are warmed by adjacent rock surfaces. Generally the temperature of the earth increases about 10°C for every 30 metres of depth (Waring, 1965). Consequently the deeper the flow system the warmer will be the waters issuing from a spring. In Canada, temperatures with a high of 85°C have been recorded, although their average temperature is approximately 45°C (Souther and Halstead, 1973).

Nonthermal mineral springs, on the other hand, are generally associated with regions of relatively flat topography and rocks of sedimentary origin. The rock types are older and flow systems much shallower. Consequently, they are more common in the plains and eastern portions of Canada.

4.2 Mineral Constituents

Thermal and mineral springs are classified by the amount and type of dissolved minerals and gasses. (Souther and Halstead, 1973). The principal mineral substances dissolved in mineral waters are similar to

that of the rock types they flow through. Mineral concentrations vary depending on the solubility of rock and the depth of the flow system.

The basic elements which determine the type of mineral water are generally the calcium, magnesium, sodium and potassium cations, and the sulphate, chlorate, nitrate, carbonate and bicarbonate anions.

Sodium and potassium are common constituents of many minerals, chiefly the sodium and potassium feldspars. Because these compounds are highly soluble, these minerals are commonly present in highly concentrations. Calcium and magnesium are derived from limestone and dolomite. Where these rock types are present, mineral springs possess high concentrations of these minerals. Calcium is also responsible for high carbonate and bicarbonate levels.

Sulfate is one of the commonest and most plentiful constituents in solution. Sulfate results from the solution of gypsum and anhydrite. It may also be derived from the oxidation of sulfide minerals, chiefly pyrite and marcasite (Waring, 1965). In addition, sulfides principally Hydrogen sulfide (H_2S) are derived from the reduction of the sulfate minerals.

Chloride is generally found in most mineral waters but is especially prominent in mineral springs found near the ocean and seawater forms a portion of the flow system.

Silica is practically always present, but in comparatively small amounts. Nearly all rocks contain silica but it is highly insoluble.

Other minerals are sometimes present in lesser quantities. Although unimportant quantitatively, they can have a major influence on the character of the water (Paquet, 1964). These include iodine, bromine, boron, arsenic, barium, phosphorus, selenium, strontium and radium. Iron in the form of iron oxide is responsible for the "paint pots" found in

Kootenay National Park (van Everdingen, 1972). Large quantities of iron oxide deposited by the spring water causes large, bright yellow to reddish-brown deposits to be formed. Indians reportedly utilized these deposits for the preparation of paints and garment decoration. In the early 1900's, a paint manufacturer from Calgary mined this material.

4.3 Caseous Constituents

The waters from many springs contain dissolved gases. The most common gas given off is carbon dioxide, especially in springs emanating from limestone or dolomite. Hydrogen sulfide is also common, and is derived from the reduction of gypsum and other sulfates. This gas accounts for the "rotten egg" odor prominent at many springs. Nitrogen is found in some springs but is not considered a common constituent. Dissolved oxygen can as well be present.

4.4 Medicinal Properties

Mineral and thermal springs have long been recognized for their reputed therapeutic value. The development of these springs for bathing (thermal springs) and bottled water (mineral springs) has been an important use over the decades. Recently their use for producing geothermal power has been investigated (Souther and Halstead, 1973). These factors have resulted in the development of many springs into health spas or bottled water facilities.

Bio-physiological research in Europe has clearly demonstrated the effectiveness of mineral waters (Paquet, 1964). Mineral waters have been used in the treatment of digestive, respiratory, skin, gynecological and articular ailments.

One notable serious hazard is associated with thermal spring waters. The disease, Primary Amoebic Meningoencephalitis is caused by an amoeba, Naegleria fowleri and is always fatal (Atkinson, 1979). It is found in warm waters, such as natural hot springs, and was a health concern when the Banff and Jasper Aquacentres were developed. Only some one hundred cases have been recorded in the world, consequently the risk is very low. However, the high fatality rate requires an appraisal of the potential health hazard. Atkinson (1979) determined that filtration and chlorination is an effective treatment process.

4.5 Flora

Most plant species surrounding mineral and thermal springs are unique in their ecological characteristics and generally differ from the surrounding region. Thermal springs are important stepping-stones for the migration of many plants and may host plants which are out of their normal area of distribution (disjunct). A good example of a disjunct plant is Sphenopholis intermedia, which is common in thermal springs of northern British Columbia, the Yukon and Alaska. Its normal habitat is in the warmest sections of southern British Columbia. The occurrence of Adiantum capillis-verneris at Fairmont Hot Springs is exceptional because it is normally found in Utah and central California (Ceska, 1980). In addition, the mineral composition and warm waters tend to cause the development of both plant and animal species and communities adapted only to mineral and thermal spring environments (Ceska, 1980). Agrostis rossae and Panicum thermale are examples of such species.

The effect of the thermal springs on the vegetation varies depending on many factors. The size of the hot spring and area influenced by its heated waters are important factors in determining the richness of the flora. Generally the larger the catchment area, the more diverse the flora. The building of the calcareous tufa deposits also influences the vegetation diversity. The calcareous substrate creates habitats suitable for calciphilous plant species. Consequently thermal springs with tufa deposits are richer because of a greater diversity of habitats.

Filamentous algal communities are common in most mineral and thermal springs. These vary from green, red, and brown depending on spring water temperature. Green species flourish in water having a temperature of about 49° to 60°C, orange and red species in water of about 60° to 71°C and white varieties in water hotter than 71°C (Waring, 1965).

4.6 Fauna

In general, mineral and thermal springs do not develop unique animal communities. However, they are very important to large mammals as a source of minerals (mineral licks). They can also support a diverse number of birds and small mammals due to the variety of habitats and food services available near thermal springs.

Of special interest are the occurrence of two endangered molluscs which only inhabit thermal springs. Physa johnsoni, the Banff Springs tadpole snail, is found only in warm and in cool springs near Banff, Alberta. A second species of Physa, as yet undescribed, lives in the cool water adjacent to the warm effluent stream of Liard Hot Springs in northern British Columbia (Mosquin and Suchal, 1976). Although not endangered, it is interesting to note that the lake chub (Coresius plumbeus), a very adaptable species is commonly encountered in thermal springs. Tropical fish such as the mosquitofish (Gambusia affinis), sailfin molly (Poecilia latipinna) and jewelfish (Hemichromis limaculatus) are found in the outlets of the Cave and Banff Basin Hotsprings (Nelson, 1982). The Banff longnose dace (Rhinichthys cataractoe smithii) is one restricted to these same environments.

4.7 Deposits

Thermal and mineral springs with high levels of dissolved solids especially calcium, magnesium and silicon can deposit large amounts of these minerals in the form of calcium carbonate or siliceous sinter. Mixtures of these two can form a silico-calcareous sinter in places. Large deposits of calcium carbonate known as tufa or travertine are by far the most common, sometimes forming cones or flat plateaus 15 metres in height.

5.0 INVENTORY

The inventory of the mineral and thermal springs in Canada has identified 62 mineral springs and 119 thermal springs based on literature reviews and personal knowledge. Appendices A (mineral) and B (thermal) provide a detailed inventory of the physical and biological characteristics of each mineral and thermal spring identified as outlined in Section 3.0. Map 1 in the map pocket shows their location. The locations of these springs have been divided by physiographic regions for discussion and illustrating distribution patterns. Each region is characterized by distinctive elements of geology, topography and climate which can influence the character and type of springs. Table 5-1 shows the distribution of the mineral and thermal springs in Canada by physiographic region. The Cordilleran region was broken into three systems because of its complexity. Areas were also identified to further locate the general geographical area.

Table 5-1 illustrates that all the thermal springs are found in the Cordilleran region, with most occurring in the Western and Eastern systems. The Cordilleran region is tectonically young with numerous areas of volcanic activity that began in the late Palaeozoic and continued into Tertiary time. In addition, the high local relief leads to very deep circulation of groundwater and its associated high thermal gradient with depth.

Mineral springs, on the other hand, occur mainly in the Interior Plains, Appalachian and St. Lawrence Lowland regions where the underlying strata are flat-lying sedimentary rocks which include beds of salt and gypsum.

It should be noted that no thermal springs are known to occur in the Canadian Shield, Inuitian and Arctic Lowlands regions. The Canadian Shield is the largest physiographic region and is underlain almost totally by granitic and metamorphic rocks which have been stable since Precambrian time. The rocks have a low permeability, shallow groundwater systems, and are slow to weather. Consequently, the groundwater is similar to the surface waters in temperature and is low in total dissolved solids.

The Arctic Lowlands and Inuitian regions are in the zone of continuous permafrost that restricts deep groundwater circulation.

Both thermal and mineral springs tend to occur in groups (see map). This indicates that they are probably related to a similar geological feature or groundwater system especially when they exhibit similar water quality parameters.

5.1 Cordilleran Region

The Cordilleran Region is predominantly mountainous and includes all the mainland westward from the eastern margin of the foothills of the Rocky Mountains as well as Vancouver Island and the Queen Charlotte Islands. It is divided into three subdivisions called "Systems" which run in a northwest-trending direction. The Western System which is dominated by the Coast Mountains is composed of granite and metamorphic rocks. Elevations reach 3000 m. The Eastern System comprises the Rocky Mountains and Rocky Mountain Foothills. This system is underlain by sedimentary and metamorphic rocks. Intrusive rocks are few and of no geomorphic significance. The rocks of this system have been severely folded and eroded to produce spectacular mountain and alpine landscapes. Between these two systems lies the Interior System which consists of a mixed pattern of plateaus and mountains. The underlying rocks are a mixture of volcanic and folded and faulted sedimentary rocks. Much of the central plateau of British Columbia is covered by flat-lying, late tertiary basalts. Over 130 centres of Pleistocene and recent volcanic activity are scattered throughout the Interior and Western Systems (Souther and Halstead, 1973).

Liard Basin and Northern Yukon and Northwest Territories springs contain the most natural and outstanding examples of thermal spring development found in the Interior System. Large terraced travertine formations, high water temperatures and interesting flora are all characteristic features of these springs. These springs issue from deep flow systems in sedimentary rocks composed of limestone and shales. The two Interior Plateau springs are cool springs that just meet the requirements to be classed as thermal. They have low flows and small deposits of travertine.

TABLE 5-1. Number of Thermal and Mineral Springs by Region

REGION	THERMAL SPRINGS	MINERAL SPRINGS
Cordilleran		
Western System		
Vancouver Island	3	1
Lower Mainland	9	1
Northwest	10	1
Northcoast	21	1
Interior System		
Columbia Mtn.	14	1
Interior Plateau	2	2
Liard Basin	7	-
Northern Yukon and Northwest Territories	6	-
Eastern System		
Rocky Mtn.	28	4
Liard Basin	9	-
Northwest Territories	10	-
Interior Plains	-	8
Canadian Shield	-	1
Arctic Lowlands	-	-
Innuitian	-	-
St. Lawrence Lowlands	-	23
Appalachian	-	19
TOTAL	119	62

5.1.1 Thermal Springs of the Cordilleran Region

A total of 119 thermal springs were described in this region (Table 5-1). These are distributed in the three systems in the following manner:

Western System: 43

Interior System: 29

Eastern System: 47

The thermal springs in the Western System are concentrated (21) on the northcoast area of British Columbia. In general, these springs occur near sea-level and discharge from fissures in quartz diorite. The total dissolved solids are low and no development of travertine is present. Ten springs (10) are located near Mt. Edziza and are probably related to the volcanic activity. These have higher total dissolved solids and some form travertine deposits. The remaining 12 springs are found on the west coast of Vancouver Island (3) and in the lower mainland (9) mainly in the Lillooet Valley. All are lightly mineralized with temperatures generally exceeding 40°C.

None of the springs in the Western System are known to exhibit any unique biological characteristics.

The Interior System contains 29 thermal springs with the majority occurring in the Columbia Mountains (14). Most of this area is underlain by metamorphic and sedimentary rocks that have been folded and faulted. All the known springs are found associated with fault systems which are generally north-trending. These springs are calcium sulphate types and produce travertine deposits. Many have been developed as bathing facilities because of their favorable temperatures and medicinal qualities.

The remaining springs are grouped in three areas, the Liard Basin (7), Northern Yukon and Northwest Territories (6) and Interior Plateau (2).

The Eastern System contains the highest number of thermal springs in the Cordilleran Region (Table 5-1). The best known springs occur in the southern Rocky Mountains. Tourist and health resorts are found at most of the thermal springs. All issue from folded and faulted Cambrian and Devonian limestone, and have relatively high water temperatures, high levels of total dissolved solids and formations of travertine where development has not destroyed the natural features. Many of these springs are found in existing national parks.

Nineteen thermal springs are found in the Liard Basin and Northwest Territories areas of the Eastern System. The majority of these are presently in their natural state and exhibit excellent examples of the abiotic and biotic features of thermal springs.

5.1.2 Mineral Springs of the Cordilleran Region

The Cordilleran region contains 11 known mineral springs. Four occur in the Eastern System, 3 in the Interior System and 4 in the Western System.

The springs found in the Western System with the exception of Mt. Meager are brine springs with high sodium contents. The intrusion of seawater into the groundwater flow systems is believed to be the cause. The spring at Kwinitza is the only one that was developed for brine production. Numerous springs are found in the Mt. Meager area. Several of the springs have extensive terraced travertine deposits and large flows. No information is available on their biological characteristics.

The springs in the Interior System originate in flat-lying basalt deposits. The climate in the area is mainly dry with grassland/forest vegetation. Small travertine formations have developed at the springs and the vegetation is usually lush in comparison to the adjacent grasslands, however, cattle grazing and trampling has destroyed many of natural characteristics of the springs.

The Eastern System contains 4 mineral springs all in the Rocky Mountains in or near Banff National Park. Canmore, Fortune and Panther River springs are very small, originating at the base of talus slopes and possess few interesting characteristics. The Ink Pots are the most significant springs because of the surrounding beauty of the subalpine forest environment and unique coloration of the water due to suspended solids.

5.2 Interior Plains Region

The Interior Plains lie between the Cordillera and the Canadian Shield. Pleistocene deposits cover the entire area and are underlain by flat-lying strata of Palaeozoic, Mesozoic and Tertiary age. No thermal springs are found in this region, probably because of the shallow groundwater flow systems, lack of volcanic activity, and low topographic relief. However, numerous mineral springs are present especially along the eastern portion of the region.

5.2.1 Mineral Springs of the Interior Plains Region

The 8 springs found in the Interior Plains region are diverse in their physical and biological characteristics. The 6 springs found along Lake Winnipeg and near Lake Athabaska are brine springs. Some were developed for salt production in the late 1800's. Most areas are devoid of vegetation because of the high salt contents. Many and Big Hill Springs which occur near the Rocky Mountains are calcium bicarbonate types. Big Hill Spring has extensive travertine deposits, while Many Springs form a calcareous fen which is exceptional in its diverse flora and fauna with many rare plant species found.

5.3 Canadian Shield Region

The Canadian Shield Region is the largest physiographic region in Canada. It is underlain almost wholly by granitic and metamorphic rocks of Precambrian age. The rocks are of low porosity and nearly all groundwater arises from rock fractures or permeable surficial materials. The surface and groundwaters are characteristically low in dissolved solids because of the shallow flow systems and difficult to weather rock types. Consequently, no thermal and only one (1) known mineral spring are found in the Canadian Shield Region.

5.4 Saint Lawrence Lowland Region

The Saint Lawrence Lowland Region is underlain by flat-lying Palaeozoic sedimentary rocks composed of limestone, dolomite, shales, and some sandstones. Spring discharge is commonly less than 40 l/min and dissolved solids less than 14,000 ppm. No thermal springs are known to occur in this region. Twenty-three mineral springs have been recorded; most were developed as bottled water facilities early in the 1900's.

5.5 Appalachian Region

The Appalachian Region is an upland area sloping in a southeasterly direction. Valleys and flat lowlands dissect the upland areas. Folded crystalline and sedimentary rocks occupy the uplands while flat-lying sedimentary rocks cover the valleys and lowlands. The sedimentary rocks are dominated by beds of limestone, shale, gypsum, rock salt and anhydrite.

No thermal springs are known to occur, although numerous mineral springs are present. These mineral springs generally exhibit small flows (less than 40 l/min) and high total dissolved solids (range 3300 - 65,000 ppm). Because of the high salinity of the sedimentary rocks, the springs all exhibit very high sodium chloride levels. Most of the 19 springs found in this region were developed by the salt industry in the early 1900's.

6.0 ASSESSMENT

The assessment of the thermal and mineral springs was conducted using the methodology outlined in Section 3.2. Using this methodology, a value of 0 to 5 was assigned to each of the assessment criteria on a qualitative basis. Where no data was available, it was indicated by the appropriate symbol. Two scores were calculated. The "total score" is the total of all features recorded. A superscript beside the total score indicates the number of categories with information to allow evaluation. The "standardized total" is the total score divided by the number of categories evaluated times 100. An asterisk (*) beside the standardized score indicates those springs where 50 percent or less of the categories have recorded data.

Table 6-1 illustrates the results of this assessment for thermal springs while Table 6-2 shows the results for mineral springs. In addition to showing the total scores, these tables indicate for each assessment criteria the value assigned, thus allowing each spring to be analyzed and the significance of its individual feature noted.

TABLE 6-1: THERMAL SPRING ASSESSMENT

SPRING NAME & NUMBER	ASSESSMENT CRITERIA											Total	STANDARDIZED TOTAL
	Travertine Formations	Cascading Waterfalls	Spring Temperatures	Volume of Discharge	Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities Diversity	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness		
1. Skookumchuk	1	0	3	2	2	2	2	2	N.D.	N.D.	1	15 ⁹	167
2. Frank Creek	2	0	1	3	0	N.D.	2	2	N.D.	N.D.	5	14 ⁸	175
3. Clear Creek	0	0	3	3	2	3	0	0	N.D.	N.D.	2	13 ⁹	144
4. Sloquet Creek	1	4	5	3	2	4	2	2	0	0	4	27 ¹¹	245
5. Meager Creek	0	0	4	4	1	4	1	1	N.D.	N.D.	3	18 ⁹	200
6. Pebble Creek	2	2	4	3	2	4	3	2	N.D.	1	4	27 ¹⁰	270
7. Pitt River	0	1	4	1	1	3	1	1	0	0	5	17 ¹¹	155
8. Harrison(Sulfur)	0	0	4	4	1	4	0	0	0	0	0	13 ¹¹	118
9. Mt. Cayley	1	1	2	2	1	4	N.D.	N.D.	N.D.	N.D.	5	16 ⁷	229
10. Flores Island	2	0	1	1	2	N.D.	0	0	0	N.D.	1	7 ⁹	77
11. Sharp Point	0	4	4	4	3	4	2	2	0	N.D.	3	25 ¹⁰	250
12. Fair Harbour, Kyuquot Sound	0	0	3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	5	8 ⁴	200*
13. Knight Inlet	0	0	5	3	2	3	2	2	N.D.	N.D.	5	22 ⁹	244
14. Nascall Bay	0	0	3	2	0	3	1	1	N.D.	N.D.	1	11 ⁹	122
14a.Eucott Bay	0	0	5	4	1	2	1	1	N.D.	N.D.	2	16 ⁹	178
15. Link Lake	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	5	5 ²	250*
16. Bella Coola	0	0	2	1	0	N.D.	1	1	N.D.	N.D.	5	10 ⁸	125
17. Sheemahant River	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	5	5 ²	250*
18. Wash Wash River	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	5	5 ²	250*
19. Bentinck Arm 2	0	N.D.	2	1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	5	8 ⁴	200*

Table 6-1 (continued)

SPRING NAME & NUMBER	ASSESSMENT CRITERIA											Total	STANDARDIZED TOTAL
	Travertine Formations	Cascading Waterfalls	Spring Temperatures	Volume of Discharge	Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness		
20. Taiheo	0	0	4	3	5	4	1	1	N.D.	N.D.	3	21 ⁹	233
21. Weewanle Creek	0	0	3	2	2	4	0	0	N.D.	N.D.	2	13 ⁹	144
22. Brim River	0	0	3	1	1	4	0	0	N.D.	N.D.	5	14 ⁹	156
23. Shearwater Point	0	0	3	3	2	4	1	1	N.D.	N.D.	5	19 ⁹	211
24. Bishops Cove(bay)	0	0	3	2	1	4	0	0	N.D.	N.D.	0	10 ⁹	111
25. Klekane Inlet	0	0	3	3	2	4	1	1	N.D.	N.D.	2	15 ⁹	167
26. Ursula Channel	0	0	3	1	1	4	1	1	N.D.	N.D.	5	16 ⁹	178
27. Brynildsen Inlet	0	0	2	1	1	N.D.	N.D.	N.D.	N.D.	N.D.	5	9 ⁶	150
28. Frizzell Hot-Springs	0	0	3	4	3	3	1	1	N.D.	N.D.	2	17 ⁹	189
29. Lakelse Hot Springs	0	0	5	3	4	3	2	3	0	N.D.	2	22 ¹⁰	220
30. HotSpring Island	0	0	4	3	3	3	0	0	N.D.	N.D.	3	16 ⁹	178
31. Burton Creek	0	0	3	1	1	3	0	0	N.D.	N.D.	5	13 ⁹	144
32. Alyansh	0	0	5	2	3	3	1	2	N.D.	N.D.	5	21 ⁹	233
33. Stikine River	0	0	4	5	4	4	1	1	N.D.	N.D.	5	24 ⁹	267
34. Mess Lake Hot-Springs	4	2	3	2	4	3	N.D.	N.D.	N.D.	1	5	24 ⁸	300
35. Sphaler Creek	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	-
36. Mess Creek	3	0	3	N.D.	2	3	2	1	N.D.	N.D.	5	19 ⁸	238
37. Taweh Creek Hot-Spring	3	0	3	2	2	3	2	1	N.D.	N.D.	5	21 ⁹	233
38. Elwyn Creek	4	3	2	4	4	2	1	1	N.D.	1	5	27 ¹⁰	270
39. Len King Creek	0	0	N.D.	1	1	N.D.	0	0	N.D.	N.D.	5	7 ⁷	100

SPRING NAME & NUMBER	ASSESSMENT CRITERIA											Total	STANDARDIZED TOTAL
	Travertine Formations	Cascading Waterfalls	Spring Temperatures	Volume of Discharge	Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities Diversity	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness		
40. Iskut River	0	0	1	1	1	N.D.	0	0	N.D.	N.D.	5	8 ⁸	100
41. Sheslay	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	-
42. Atlin Spring	4	3	2	5	4	4	2	2	N.D.	N.D.	3	29 ⁹	322
43. Crawford Creek	0	0	2	1	1	N.D.	N.D.	N.D.	N.D.	N.D.	5	9 ⁶	150
44. Alnsworth	4	3	3	3	4	4	N.D.	N.D.	N.D.	N.D.	3	24 ⁷	343
45. Fry Creek	0	0	N.D.	1	1	N.D.	N.D.	N.D.	N.D.	N.D.	5	7 ⁵	140*
46. Kaslo	3	0	1	3	3	3	N.D.	N.D.	N.D.	N.D.	3	16 ⁷	228
47. Wilson Lake	0	0	3	1	1	N.D.	N.D.	N.D.	N.D.	N.D.	5	10 ⁶	167
48. St. Leon Creek	2	1	4	3	2	3	2	2	2	N.D.	3	24 ¹⁰	240
49. Halfway River	0	0	4	2	1	3	0	0	0	0	5	15 ¹¹	136
50. Halcyon	0	0	4	3	2	3	1	1	1	4	1	20 ¹¹	182
51. Nakusp	0	0	4	1	1	3	0	0	0	0	0	9 ¹¹	82
52. Albert Canyon	0	0	2	3	2	3	N.D.	N.D.	N.D.	N.D.	2	12 ⁷	171
52a. Grizzly Creek	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	-
53. Octopus Creek	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	-
54. Dewar Creek	5	3	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	13 ³	433*
55. Taylor Spring	0	0	2	1	1	3	0	0	0	0	0	7 ¹¹	64
56. Jordan Ranch Spring	0	0	1	1	1	1	0	0	0	0	0	4 ¹¹	36
57. Clearwater	1	0	1	1	1	2	N.D.	N.D.	N.D.	N.D.	N.D.	6 ⁶	100
58. Williams Lake Spring	1	0	1	1	1	2	N.D.	N.D.	N.D.	N.D.	N.D.	6 ⁶	100

ASSESSMENT CRITERIA

SPRING NAME & NUMBER	Travertine Formations	Cascading Waterfalls	Spring Temperatures	Volume of Discharge	Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities Diversity	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness	Total	STANDARDIZED TOTAL
59. Portage Brule	1	0	4	2	3	3	2	2	0	N.D.	3	20 ¹⁰	200
60. Liard River	4	2	4	5	5	4	4	5	1	1	4	39 ¹¹	355
60a. Deer River	3	3	3	5	3	3	4	3	0	1	5	33 ¹¹	300
61. Crooked Lake	0	0	2	2	2	1	1	2	0	0	5	15 ¹¹	136
62. Coal River Springs	5	4	1	5	4	4	3	3	2	0	5	36 ¹¹	327
63. Watson Lake	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	-
64. Otter Creek	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	-
65. Cantung Hot Spring	0	0	3	2	1	2	0	0	0	0	0	8 ¹¹	73
66. Takhlini River Springs	0	0	3	3	1	2	0	0	0	0	1	10 ¹¹	91
67. McArthur Hot Springs	0	0	3	4	2	3	N.D.	N.D.	N.D.	N.D.	5	17 ⁷	243
68. Nahanni North	2	0	3	3	2	3	2	3	N.D.	N.D.	5	23 ⁹	256
69. Broken Skull	2	0	2	5	2	1	2	2	N.D.	N.D.	5	21 ⁹	233
70. Nahanni Head-Water	0	0	4	5	2	3	N.D.	N.D.	N.D.	N.D.	5	19 ⁷	271
71. Buhl Creek	0	0	2	1	1	N.D.	N.D.	N.D.	N.D.	N.D.	5	9 ⁶	150
72. Ram Creek	1	0	2	2	2	3	1	1	N.D.	N.D.	3	15 ⁹	167
73. Lussier River	1	0	3	3	2	3	0	0	N.D.	N.D.	1	13 ⁹	144
73a. Wild Horse River	3	1	2	1	3	3	N.D.	N.D.	N.D.	N.D.	3	16 ⁷	228
74. Toby Creek	2	1	1	1	3	3	N.D.	N.D.	N.D.	N.D.	5	16 ⁷	228
75. Red Rock	2	0	1	1	1	N.D.	0	0	N.D.	N.D.	5	10 ⁸	125
76. Columbia Lake	3	0	0	0	0	0	0	0	N.D.	N.D.	5	8 ⁹	89

SPRING NAME & NUMBER	ASSESSMENT CRITERIA												STANDARDIZED TOTAL
	Travertine Formations	Cascading Waterfalls	Spring Temperatures	Volume of Discharge	Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness	Total	
77. Fairmont Hot-Springs	5	2	3	5	4	4	N.D.	N.D.	N.D.	N.D.	2	25 ⁷	357
78. Paint Pots	0	0	1	2	4	1	1	1	N.D.	N.D.	4	14 ⁹	156
79. Radium Hot Springs	0	0	3	4	4	0	0	0	N.D.	N.D.	0	11 ⁹	122
80. The Cave	4	0	3	4	3	4	5	5	5	4	3	36 ¹¹	327
81. Upper Hot Spring	0	0	3	3	1	4	0	0	0	0	0	11 ¹¹	100
82. Middle Spring	3	0	3	2	2	3	5	5	4	2	4	30 ¹¹	272
83. Kidney Spring	0	0	2	2	1	3	0	0	0	0	0	8 ¹¹	73
84. Banff Basin	1	0	2	3	1	4	5	5	5	4	3	33 ¹¹	300
85. Stoney Squaw Mtn.	0	0	1	1	1	3	0	0	0	0	0	6 ¹¹	55
86. Vermillion Lake	0	0	1	2	1	3	0	0	0	4	0	11 ¹¹	100
87. Fortymile Creek	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	-
88. Turtle Mtn.	0	0	1	3	1	2	1	1	N.D.	N.D.	4	13 ⁹	144
89. Fording Mtn.	0	0	2	2	3	2	3	4	N.D.	1	4	21 ¹⁰	210
90. Canoe River	0	0	4	3	2	3	N.D.	N.D.	N.D.	N.D.	2	14 ⁷	200
91. Miette Hot Springs	2	1	3	3	3	3	2	2	N.D.	N.D.	3	22 ⁹	244
92. Cold Sulfur Springs	1	0	1	1	1	3	N.D.	N.D.	N.D.	N.D.	5	12 ⁷	171
92a Athabaska River	0	0	2	N.D.	0	N.D.	0	0	N.D.	N.D.	5	7 ⁷	100
93. Peace River	2	0	3	3	2	N.D.	N.D.	N.D.	N.D.	N.D.	5	15 ⁶	250
94. Sikanni Chief	2	1	1	2	2	3	1	1	0	0	5	18 ¹¹	164
95. Prophet River	2	1	2	2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	5	12 ⁵	240*
96. Toad River	3	0	3	2	3	3	4	4	0	1	5	28 ¹¹	254

Table 0-1 (continued)

SPRING NAME & NUMBER	ASSESSMENT CRITERIA											Total	STANDARDIZED TOTAL
	Travertine Formations	Cascading Waterfalls	Spring Temperatures	Volume of Discharge	Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities Diversity	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness		
97. Grand Canyon of the Liard	1	1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	5	7 ³	233*
98. Lepine Creek	1	0	1	1	1	3	1	2	N.D.	N.D.	5	15 ⁹	167
99. Sulfur Creek	2	1	1	1	1	3	1	2	N.D.	N.D.	5	17 ⁹	189
100. Brimstone Creek	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	5	5 ¹	500*
101. Crusty Creek	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	5	5 ¹	500*
102. Grayling River	5	4	4	5	5	4	4	4	1	0	5	41 ¹¹	373
103. Pool Creek	1	1	4	2	1	3	2	2	N.D.	N.D.	5	21 ⁹	233
104. Larson Creek	3	0	4	4	4	3	3	4	N.D.	N.D.	5	30 ⁹	333
105. Rabbitkettle	5	4	2	3	5	4	4	4	3	0	5	39 ¹¹	354
106. Clausen Creek South	0	0	3	4	4	3	0	0	N.D.	N.D.	3	17 ⁹	189
107. South Nahanni- Ironsprings	0	0	1	1	1	1	0	0	N.D.	N.D.	5	9 ⁹	100
108. Wild Mint Spring	3	1	2	4	5	3	2	3	N.D.	N.D.	5	28 ⁹	311
109. Hole-in-the-Wall	1	0	3	4	3	3	N.D.	N.D.	N.D.	N.D.	5	19 ⁷	271
110. Ekwil Spring	2	2	3	4	2	3	N.D.	N.D.	N.D.	N.D.	5	20 ⁷	286
111. South Redstone	2	0	4	3	2	3	2	2	N.D.	N.D.	5	23 ⁹	256
112. Grizzly Bear	2	0	3	2	4	3	N.D.	N.D.	N.D.	N.D.	5	19 ⁷	271
113. Roche-Oul-Trempe- A-Leau	1	2	2	1	1	4	4	3	N.D.	N.D.	5	23 ⁹	256
114. Old Fort Island	0	0	1	5	2	3	N.D.	N.D.	N.D.	N.D.	5	16 ⁷	178

TABLE 6-2: MINERAL SPRING ASSESSMENT

SPRING NAME & NUMBER	Travertine Formations	Cascading Waterfalls	Volume of Discharge	ASSESSMENT CRITERIA							Total	STANDARDIZED TOTAL
				Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities Diversity	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness		
1. Fishells Brook	0	0	1	1	3	0	0	0	0	0	51 ⁰	50
2. Orangedale	0	0	1	1	3	0	0	0	0	0	51 ⁰	50
3. Cape Breton Island	0	0	3	2	2	N.D.	N.D.	N.D.	N.D.	5	12 ⁶	200
4. Bucklaw	0	0	2	1	2	0	0	0	0	3	81 ⁰	100
5. Glendyer	0	0	1	1	4	N.D.	N.D.	N.D.	N.D.	N.D.	6 ⁵	120*
6. Baddeck	0	0	1	1	4	N.D.	N.D.	N.D.	N.D.	N.D.	6 ⁵	120*
7. Etheridge	0	0	1	2	4	N.D.	N.D.	N.D.	N.D.	5	12 ⁵	240*
8. Pomquet River	0	0	1	1	2	0	0	0	0	5	91 ⁰	90
9. Pomquet Intervale	0	0	1	1	3	0	0	0	0	5	101 ⁰	100
10. Dunmore	0	0	1	2	2	N.D.	N.D.	N.D.	N.D.	5	10 ⁶	167
11. Antigonish	0	0	1	2	4	N.D.	N.D.	N.D.	N.D.	5	12 ⁶	200
12. Brierly Brook	0	0	1	1	5	N.D.	N.D.	N.D.	N.D.	5	12 ⁶	200
13. Kemptown, N.S.	0	0	1	1	3	N.D.	N.D.	N.D.	N.D.	5	10 ⁶	167
14. Salt Spring, N.S.	0	0	1	1	2	N.D.	N.D.	N.D.	N.D.	3	7 ⁶	117
15. Oxford District	0	0	1	1	5	N.D.	N.D.	N.D.	N.D.	2	9 ⁶	150
16. Windsor District	0	0	2	2	3	N.D.	N.D.	N.D.	N.D.	5	12 ⁶	200
17. Sussex	0	0	1	2	4	0	0	0	0	1	81 ⁰	80
18. Salina	0	0	1	2	3	0	0	0	0	1	71 ⁰	70
19. Potton Spring	0	0	1	1	2	0	0	0	0	0	41 ⁰	40
20. Radnor Forges	0	0	2	1	3	0	0	0	0	0	61 ⁰	60
21. St. Genevieve	0	0	2	1	3	0	0	0	0	0	61 ⁰	60

Table b-2 (continued)

SPRING NAME & NUMBER	Travertine Formations	Cascading Waterfalls	Volume of Discharge	ASSESSMENT CRITERIA							Total	STANDARDIZED TOTAL
				Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities Diversity	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness		
22. Maskinonge	0	0	1	1	3	N.D.	N.D.	N.D.	N.D.	N.D.	5 ³	167*
23. Aetna	0	0	1	1	3	0	0	0	0	0	6 ¹⁰	50
24. St. Leon	0	0	2	1	3	0	0	0	0	0	6 ¹⁰	60
25. Philodor	0	0	2	1	3	0	0	0	0	0	6 ¹⁰	60
26. Riviere-du-Loup	0	0	1	1	3	0	0	0	0	0	5 ¹⁰	50
27. Richelieu	0	0	1	2	3	0	0	0	0	0	6 ¹⁰	60
28. Abenakis Springs	0	0	1	2	3	0	0	0	0	0	6 ¹⁰	60
29. Oka	0	0	1	2	3	0	0	0	0	0	6 ¹⁰	60
30. St. Benoit	0	0	1	1	3	0	0	0	0	0	5 ¹⁰	50
31. Varennes	0	0	1	1	3	0	0	0	0	0	6 ¹⁰	60
32. Berthier	0	0	1	1	3	0	0	0	0	0	5 ¹⁰	50
33. La Providence	0	0	1	1	3	0	0	0	0	0	5 ¹⁰	50
34. Joliette	0	0	1	2	3	0	0	0	0	0	6 ¹⁰	60
35. Coulombia	0	0	1	2	3	0	0	0	0	0	6 ¹⁰	60
36. St. Germain	0	0	1	2	3	0	0	0	0	0	6 ¹⁰	60
37. Carlsbad Springs	0	0	1	2	3	0	0	0	0	0	6 ¹⁰	60
38. Borthwick Spring	0	0	1	2	3	0	0	0	0	0	6 ¹⁰	60
39. Dominion Spring	0	0	1	2	3	0	0	0	0	0	6 ¹⁰	60
40. Diamond Park	0	0	1	2	3	0	0	0	0	0	6 ¹⁰	60
41. Victoria Sulfur, Ont.	0	0	1	1	N.D.	0	0	0	0	0	2 ⁹	22
42. Caledonia	0	0	1	2	3	0	0	0	0	0	6 ¹⁰	60

Table 6-2 (continued)

SPRING NAME & NUMBER	ASSESSMENT CRITERIA										Total STANDARDIZED TOTAL	
	Travertine Formations	Cascading Waterfalls	Volume of Discharge	Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities Diversity	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness		
43. Chambord	0	0	1	2	3	0	0	0	0	0	6 ¹⁰	60
44. Pine River	0	0	2	3	3	1	1	N.D.	N.D.	2	12 ⁸	150
45. Lake Winnipeg	0	0	N.D.	3	3	1	1	N.D.	N.D.	2	8 ⁷	114
46. Salt Point	0	0	2	4	3	1	1	N.D.	N.D.	2	13 ⁸	163
47. Red Deer River	0	0	1	4	3	1	1	N.D.	N.D.	3	13 ⁸	163
48. Salt River	0	0	1	3	4	1	1	N.D.	N.D.	5	15 ⁸	188
49. La Saline	1	0	1	4	3	1	1	N.D.	N.D.	5	16 ⁸	200
50. Big Hill	4	0	3	2	N.D.	2	2	0	N.D.	5	18 ⁸	225
51. Many	1	0	5	5	4	5	4	5	3	4	36 ¹⁰	360
52. Canmore	0	0	1	1	3	1	1	N.D.	N.D.	5	12 ⁸	150
53. Fortune Spring	0	0	N.D.	2	3	2	2	N.D.	N.D.	5	14 ⁷	200
54. Panther River	0	0	1	1	3	1	1	N.D.	N.D.	5	12 ⁸	150
55. Ink Pots	1	0	3	4	2	2	3	N.D.	N.D.	5	20 ⁸	250
56. Brigham Spring	2	0	1	2	N.D.	2	2	0	2	4	15 ⁹	167
57. Riske Creek	2	0	1	1	N.D.	N.D.	N.D.	N.D.	3	4	11 ⁶	183
58. Koch Creek	1	1	1	1	N.D.	1	1	N.D.	2	5	13 ⁸	163
59. Mt. Meager	3	1	N.D.	4	3	2	2	N.D.	N.D.	5	20 ⁷	286
60. Fernwood	0	0	1	1	3	N.D.	N.D.	N.D.	N.D.	5	10 ⁶	167
61. Kwinitsun	0	0	N.D.	2	3	1	1	N.D.	N.D.	3	10 ⁷	143
62. Moore Creek	1	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	5	6 ³	200*

TABLE 8-1: Thermal and Mineral Springs found within Canadian National Parks

SPRING NAME & NUMBER	ASSESSMENT CRITERIA											Total	STANDARDIZED TOTAL
	Travertine Formations	Cascading Waterfalls	Spring Temperatures	Volume of Discharge	Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities Diversity	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness		
BANFF NATIONAL PARK - THERMAL SPRINGS													
The Cave	4	0	3	4	3	4	5	5	5	4	3	36 ¹¹	327
Upper Hot Spring	0	0	3	3	1	4	0	0	0	0	0	11 ¹¹	100
Middle Spring	3	0	3	2	2	3	5	5	4	2	4	30 ¹¹	272
Kidney Spring	0	0	2	2	1	3	0	0	0	0	0	8 ¹¹	73
Banff Basin	1	0	2	3	1	4	5	5	5	4	3	33 ¹¹	300
Stoney Squaw Mtn.	0	0	1	1	1	3	0	0	0	0	0	6 ¹¹	55
Vermillion Lake	0	0	1	2	1	3	0	0	0	4	0	11 ¹¹	100
Fortymile Creek	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	-
BANFF NATIONAL PARK - MINERAL SPRINGS													
Fortune Spring	0	0	-	N.D.	2	3	2	2	N.D.	N.D.	5	14 ⁷	200
Panther River	0	0	-	1	1	3	1	1	N.D.	N.D.	5	12 ⁸	150
Ink Pots	1	0	-	3	4	2	2	3	N.D.	N.D.	5	20 ⁸	250
JASPER NATIONAL PARK - THERMAL SPRINGS													
Miette Hot Springs	2	1	3	3	3	3	2	2	N.D.	N.D.	3	22 ¹	244
Cold Sulfur Springs	1	0	1	1	1	3	N.D.	N.D.	N.D.	N.D.	5	12 ⁷	171
Athabaska River	0	0	2	N.D.	0	N.D.	0	0	N.D.	N.D.	5	7 ⁷	100

TABLE 8-1: Thermal and Mineral Springs found within Canadian National Parks (continued)

SPRING NAME & NUMBER	ASSESSMENT CRITERIA											Total	STANDARDIZED TOTAL
	Travertine Formations	Cascading Waterfalls	Spring Temperatures	Volume of Discharge	Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities Diversity	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness		
KOOTENAY NATIONAL PARK - THERMAL SPRINGS													
Paint Pots	0	0	1	2	4	1	1	1	N.D.	N.D.	4	14 ⁹	156
NAHANNI NATIONAL PARK - THERMAL SPRINGS													
Rabbitkettle	5	4	2	3	5	4	4	4	3	0	5	39 ¹¹	354
Clausen Creek South	0	0	3	4	4	3	0	0	N.D.	N.D.	3	17 ⁹	189
South Nahanni-Ironsprings	0	0	1	1	1	1	0	0	N.D.	N.D.	5	9 ⁹	100
Wild Mint Spring	3	1	2	4	5	3	2	3	N.D.	N.D.	5	28 ⁹	311
Hole-in-the-Wall	1	0	3	4	3	3	N.D.	N.D.	N.D.	N.D.	5	19 ⁷	271

7.0 SELECTION OF OUTSTANDING THERMAL AND MINERAL SPRINGS

The standardized scores of all thermal and mineral springs were reviewed and a "cutoff value" arbitrarily selected that was representative of the springs that exhibited outstanding physical and biological characteristics. However, since complete data was not available for all springs, judgement was necessary in some cases to determine if a particular spring could contain significant representation of features without data. Using this reasoning, the following criteria were developed to select the most outstanding springs:

- over 300 (standardized score) represented by 70% of the categories
- over 250 (standardized score) represented by 80% of the categories

7.1 Thermal Springs

Table 7-1 shows the ranking of the thermal springs that scored over 250 in the assessment. Nineteen thermal springs were found to meet or exceed this standardized score. Table 7-1 first lists and ranks those springs that had complete data, then lists springs where categories are missing but still a score over 250 was achieved. These were ranked according to the number of categories with data and their standardized score. It should be noted that Fairmont and Ainsworth springs have high scores but were ranked last. These are both privately owned and fewer categories had data (biological), and while very significant, it was felt they should be ranked in the last positions.

The top 10 thermal springs in Canada are found mainly in northern British Columbia and the southern Yukon and Northwest Territories. Most have had no human disruption and exhibit both outstanding physical and biological characteristics. With the exception of the Liard River springs, all have no developed access and must be reached by helicopter. A second group of outstanding springs are found in the southern Rocky Mountains in Banff National Park. These springs have had some changes due to human disruption, but still exhibit significant physical and biological characteristics.

Table 7-1. Ranking of the Top Thermal Springs found in Canada.

Spring	# of categories	Standardized Total
1. Grayling River	11	373
2. Liard River	11	355
3. Rabbitkettle	11	354
4. Coal River	11	327
5. The Cave	11	327
6. Banff Basin	11	300
7. Deer River	11	300
8. Middle Spring	11	272
9. Toad River	11	254
10. Atlin Spring	9	322
11. Wild Mint	9	311
12. Pebble Creek	10	270
13. Elwyn Creek	10	260
14. Sharp Point	10	250
15. South Redstone	9	256
16. Roche-Oui-Trempe-a-Leau	9	256
17. Mess Lake	8	300
18. Fairmont	7	357
19. Ainsworth	7	343

The Grayling River was ranked as number one. It best exhibits a combination of outstanding physical and biological features that characterize thermal springs. The Grayling River has large terraced travertine deposits with numerous cascading waterfalls and high spring water temperatures. Diverse vegetation communities with characteristic thermal spring plant species and a number of rare species are present. Wildlife utilize the area for water in winter and as a mineral lick. Deer River thermal springs are very similar, but lack the advanced development. The nearby Liard River similarly has well developed travertine deposits and covers a large area. It has been termed the "tropical valley" because of the very lush vegetation surrounding the thermal springs.

Rabbitkettle and Coal River thermal springs are probably the best examples of terraced travertine deposits in Canada.

Three thermal springs out of the eight in Banff National Park are highly rated. With the exception of the Cave, these springs (Banff Basin and Middle Spring) are more significant for their biological (flora and fauna) features. Many rare plants are found in the marshes developed along the outflow channels. Tropical fish inhabit the pools of the Cave and Banff Basin.

The Toad River springs do not have extensive tufa deposits but do have well developed sinter cones, and a very complex and floristically diverse vegetation. The area is also an important mineral lick.

The remaining 10 thermal springs have been rated high although not all data categories were available. This indicates that these thermal springs have significant features. For example, in most cases, even if zeros replace the categories with no data, a score of 250 is achieved. Data categories missing are generally biological such as the occurrence of rare or unique species or important wildlife habitat. The majority of the score total is derived from the occurrence of outstanding physical features.

These 10 thermal springs are generally scattered throughout the Cordilleran region. Atlin and Wild Mint springs received the highest scores in this group mainly because of their large size and travertine deposits. No vegetative information exists but given the physical descriptions of the springs, characteristic thermal springs vegetation should be present. However, this would have to be confirmed by further field studies. Roche-Oui-Trempe-A-L'Eau spring is interesting because it has the highest mineral content (12,556 ppm) of any thermal spring in Canada, and is of a sodium chloride type. It supports an unusual halophytic plant community very different from characteristic thermal spring vegetation found at other springs.

It should be noted that only two thermal springs (Pebble Creek and Sharp Point) that represent springs originating in a coastal climate have been included in the top thermal springs in Canada, while almost half the known thermal springs occur in the Western System of the Cordillera. This results from the wet coastal environment and slow weathering of the Coastal Batholith bedrock. No travertine is usually formed and the heavy precipitation prevents the development of unique plant communities, both key features in the assessment of thermal springs. Consequently, coastal-occurring thermal springs have received lower scores. However, many of these coastal thermal springs have very high water temperatures and flow directly into the ocean or nearby water bodies, creating ideal conditions to enjoy the experience of soaking in these hot spring environments. Most are utilized by fishermen or local people especially during the wet winter months. Of special note are Talheo, Hot Spring Island, Sloquet River, Eucott Bay and Meager Creek.

7.2 Mineral Springs

Table 7-2 shows the ranking of mineral springs that scored over 225 following a similar assessment procedure as was conducted for the thermal springs. The "spring temperatures" assessment category was dropped for the assessment of mineral springs because it has no relevance. Consequently, the overall standardized score was reduced to 225 to account for the removal of this assessment category.

Of the 62 mineral springs identified in Canada, only four received a score above 225. These four springs are all in western Canada (British Columbia and Alberta), although the majority (70%) of the mineral springs are found in eastern Canada. The majority of eastern Canadian springs have been developed as either bottled water facilities or used for salt production in the early 1900's. Consequently, the natural character of these springs has been severely altered. In addition, it was noted during this study that generally mineral springs have fewer specialized characteristics than thermal springs. Because of the relatively cool waters, no unique plant communities form other than common wetland types, although saline springs do form rather specialized halophytic plant communities.

Many Springs in Alberta is by far the most outstanding mineral spring in Canada. It is protected by a provincial park. While it is not noted for its extensive travertine deposits, its biological features are outstanding. The springs form a large marsh area that supports a varied and complex number of plant communities as well as many rare plant species. The diversity of plant communities also creates habitats for a large number of bird and animal species.

The Mt. Meager group of mineral springs represent a large number of mineral springs, many having terraced travertine deposits. These probably represent the best examples of terraced deposits formed in a mineral spring environment. Biological information is lacking, and could further promote the importance of these mineral springs.

The Ink Pots in Banff National Park are situated in a subalpine environment surrounded by a floristically diverse fen. The Ink Pots derive their name from the greenish, milky appearance of the water in the seven small ponds. No travertine deposits are present.

Big Hill springs just outside Big Hill Provincial Park in Alberta. Large travertine deposits are present around the springs and along the outflow channel. While lush vegetation surrounds the springs, no rare or unique vegetation has been reported.

Table 7-2. Ranking of the Top Mineral Springs Found in Canada.

Spring	# of categories	Standardized Total
1. Many Springs	10	360
2. Mt. Meager	8	280
3. Ink Pots	7	250
4. Big Hill	8	225

8.0 SIGNIFICANCE OF THE THERMAL AND MINERAL SPRINGS CURRENTLY PROTECTED BY THE NATIONAL PARK SYSTEM

A total of 17 thermal springs and 3 mineral springs occur in the national parks (Table 8-1). This is 14 percent and 5 percent, respectively, of the thermal and mineral springs in Canada. These springs are found in Banff, Kootenay, Jasper and Nahanni National Parks. In addition, Radium Hotsprings occur within Kootenay National Park and Albert Canyon Hotsprings within Glacier National Park. However, since both are private, well-developed resorts, they are not included in this discussion.

Banff National Park contains 8 of the thermal springs and all 3 mineral springs. Jasper National Park has 3 thermal springs, while Kootenay National Park has 1 and Nahanni National Park contains the remaining 5.

Tables 7-1 and 7-2 indicate that of these combined 20 thermal and mineral springs, 6 were top rated out of the total of 23 (thermal and mineral) ranked. In other words, 26 percent of the most significant thermal and mineral springs in Canada are found in national parks, principally Banff and Nahanni National Parks. Banff National Park has three of the top-ranked thermal springs and the only top ranked mineral spring. Jasper has none of the top-ranked thermal springs, while Nahanni National Park has two (2).

Rabbitkettle thermal spring in Nahanni National Park was ranked as number 3 in Canada, while the Cave, Banff Basin and Middle Spring in Banff National Park were ranked 5, 6, and 8 respectively. Wild Mint Spring in Nahanni ranked 10th. Consequently, the springs presently preserved in the national park system contain excellent examples of the biological and physical characteristics of thermal springs.

Rabbitkettle thermal spring is probably the most outstanding example of terraced travertine deposits in Canada. The thermal springs found in Banff National Park are extremely rich in flora and fauna with many rare plant species present.

The Ink Pots is the only top ranked mineral spring found in a national park. It was ranked in the third position. This spring's subalpine setting, pond configuration, and its unique color are the main characteristics of interest.

TABLE 8-1: Thermal and Mineral Springs found within Canadian National Parks

SPRING NAME & NUMBER	ASSESSMENT CRITERIA											Total	STANDARDIZED TOTAL
	Travertine Formations	Cascading Waterfalls	Spring Temperatures	Volume of Discharge	Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities Diversity	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness		
BANFF NATIONAL PARK - THERMAL SPRINGS													
The Cave	4	0	3	4	3	4	5	5	5	4	3	36 ¹¹	327
Upper Hot Spring	0	0	3	3	1	4	0	0	0	0	0	11 ¹¹	100
Middle Spring	3	0	3	2	2	3	5	5	4	2	4	30 ¹¹	272
Kidney Spring	0	0	2	2	1	3	0	0	0	0	0	8 ¹¹	73
Banff Basin	1	0	2	3	1	4	5	5	5	4	3	33 ¹¹	300
Stoney Squaw Mtn.	0	0	1	1	1	3	0	0	0	0	0	6 ¹¹	55
Vermillion Lake	0	0	1	2	1	3	0	0	0	4	0	11 ¹¹	100
Fortymile Creek	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	-
BANFF NATIONAL PARK - MINERAL SPRINGS													
Fortune Spring	0	0	-	N.D.	2	3	2	2	N.D.	N.D.	5	14 ⁷	200
Panther River	0	0	-	1	1	3	1	1	N.D.	N.D.	5	12 ⁸	150
Ink Pots	1	0	-	3	4	2	2	3	N.D.	N.D.	5	20 ⁸	250
JASPER NATIONAL PARK - THERMAL SPRINGS													
Miette Hot Springs	2	1	3	3	3	3	2	2	N.D.	N.D.	3	22 ¹	244
Cold Sulfur Springs	1	0	1	1	1	3	N.D.	N.D.	N.D.	N.D.	5	12 ⁷	171
Athabaska River	0	0	2	N.D.	0	N.D.	0	0	N.D.	N.D.	5	7 ⁷	100

TABLE 8-1: Thermal and Mineral Springs found within Canadian National Parks (continued)

SPRING NAME & NUMBER	ASSESSMENT CRITERIA											Total	STANDARDIZED TOTAL
	Travertine Formations	Cascading Waterfalls	Spring Temperatures	Volume of Discharge	Number of Spring Vents or Pools	Water Quality	Floristic Diversity	Vegetation Communities Diversity	Rare & Unique Plants or Animals	Important Wildlife Habitat	Degree of Naturalness		
KOOTENAY NATIONAL PARK - THERMAL SPRINGS													
Paint Pots	0	0	1	2	4	1	1	1	N.D.	N.D.	4	14 ⁹	156
NAHANNI NATIONAL PARK - THERMAL SPRINGS													
Rabbitkettle	5	4	2	3	5	4	4	4	3	0	5	39 ¹¹	354
Clausen Creek South	0	0	3	4	4	3	0	0	N.D.	N.D.	3	17 ⁹	189
South Nahanni-Ironsprings	0	0	1	1	1	1	0	0	N.D.	N.D.	5	9 ⁹	100
Wild Mint Spring	3	1	2	4	5	3	2	3	N.D.	N.D.	5	28 ⁹	311
Hole-in-the-Wall	1	0	3	4	3	3	N.D.	N.D.	N.D.	N.D.	5	19 ⁷	271

9.0 SUMMARY AND CONCLUSIONS

This study of thermal and mineral springs in Canada was designed to inventory the physical and biological characteristics of each spring, paying particularly close attention to exceptional features. From this inventory, an assessment and ranking of the most outstanding thermal and mineral springs found in Canada was conducted.

A total of 119 thermal springs and 62 mineral springs were identified from literature reviews, interviews, and personal knowledge. All of the thermal springs are found in the Cordilleran region where the high mountainous relief creates deep groundwater flow systems. The active vulcanism also contributes to the number of thermal springs in the Western Cordilleran System. Centers of thermal spring activity include southeastern British Columbia, northeastern B.C., Southern Yukon and southwestern Northwest Territories, coastal B.C., and the area surrounding Mt. Edziza in northwestern B.C.

The thermal springs in coastal British Columbia generally have relatively high water temperatures and low mineral contents, but do not have the characteristic development of travertine deposits or unique plant communities common farther inland where the climate is much drier and bedrock geology is more conducive, e.g. easily weathered, to the formation of extensive mineral deposits. The drier climate and mineral deposits create favorable environments for the development of characteristic thermal spring vegetation.

Mineral springs are mainly found in eastern Canada in the Appalachian and St. Lawrence Lowland Region. The mineral springs in the Appalachian Region are mainly brine springs, while those in the St. Lawrence Lowland Region are bicarbonate types and used for bottled water. A second group of brine springs are found along Lake Winnipeg. The remaining mineral springs are scattered throughout British Columbia with a small concentration of six springs found west of Calgary in and near Banff National Park.

Because of the popularity of thermal springs for bathing, the natural character of many of the springs has been changed by minor and major development of the springs to better accommodate bathing. This development varies from the simple wooden tub to large concrete swimming pools and bath houses. Thermal springs with available access are naturally the ones changed the most. Similarly, mineral springs that possess water quality characteristics suitable for bottled mineral water or salt production have been altered by development.

The assessment of the thermal and mineral springs in Canada was carried out on the natural physical and biological features that make mineral and thermal spring environments unique. Eleven features were identified and assessed on a 0 to 5 scale. The summation of the scores for these eleven features was used to select and rank the springs. It should be emphasized that this assessment is designed to identify those springs that have the most outstanding representation of natural thermal and mineral features, not to assess their bathing qualities.

The assessment selected 19 thermal springs and 4 mineral springs as being the best examples of natural thermal and mineral springs in Canada. This represents 16 percent of the total number of thermal springs and 6 percent of the mineral springs. The Grayling River thermal spring in northeastern British Columbia was the top rated thermal spring, while Many Springs in Alberta was the top rated mineral spring. Many Springs is presently preserved by the Alberta Provincial Parks system, while the Grayling River is not protected.

Other thermal springs that ranked high were Liard River, Rabbitkettle, the Cave, Banff Basin, Coal River, Middle Springs, Deer River and Pebble Creek. These mainly come from two areas, Banff National Park and northeastern British Columbia. It is felt that these springs best represent a combination of characteristic physical and biological spring features. Only two springs from the coastal areas of British Columbia (Sharp Point and Pebble Creek) were ranked in the 19 thermal springs. Thermal springs on the coast are excellent bathing springs because of the

high water temperatures, they do not have extensive mineralization or unique plant communities.

Four (4) mineral springs or only 6 percent of those known in Canada were top rated. These are all located in or near Banff National Park west of Calgary except for Mt. Meager which is found northeast of Vancouver, B.C. None are found in eastern Canada where the majority of the mineral springs occur. In general, the lack of a larger number of highly rated mineral springs results from the disturbances that have taken place for bottled water facilities and salt production. In addition, the low water temperatures are not as conducive to the development of unique plant communities. Many Springs, 80 km west of Calgary, was the highest rated mineral spring.

Seventeen (17) thermal springs and 3 mineral springs are found in national parks. Banff National Park has 8 thermal springs and all the mineral springs, while Kootenay, Jasper and Nahanni National Parks have 1, 3 and 5, respectively. Of these thermal and mineral springs, 5 thermal springs and 1 mineral spring were top ranked. This represents 26 percent of the top ranked thermal springs and 25 percent of the top ranked mineral springs. Rabbitkettle in Nahanni National Park was the third ranked thermal spring while the Cave, Banff Basin and Middle Spring were rated 5, 6, and 8, respectively. This indicates that many of the top rated thermal springs in Canada are presently preserved by the national park system. Thermal springs that ranked high (Grayling River, Coal River) and are not preserved under any form of covenant should be further investigated as potential sites for Natural Sites of Canadian Significance.

10.0 REFERENCES

- Allan, J.A. 1919. Salt and Gypsum in Alberta. Canadian Inst. Min. and Met. Bull. No. 206:773-4.
- Annas, R.M. 1974. Application for Ecological Reserve. Toad River Hot Springs. Report 230. B.C. Ecological Reserves Committee.
- Arnold, Edward William. 1961. Plant Communities of a Hot Spring in the Mackenzie Mountains Northwest Territories. M.Sc. Thesis, Univ. Mich. 34p.
- Atchison, M.E. 1964. A Study of Spring Deposits in the Flat River Map-area, District of Mackenzie, N.W.T.: Bachelor of Science Thesis, University of British Columbia.
- Atkinson, J.M. 1979. The City of Bath Hotsprings - an Evaluation of Public Health Concerns. Misc. Report, Reid, Crowther and Partners, Calgary., Alta.
- B.C. Hydro and Power Authority. 1980. Liard River Area Hotsprings Information Review. Engineering Services Division. Environmental and Socio-Economic Services Department. Report ESS3.
- Beaubien, E. 1983. Avifauna and Flora of the Cave and Basin. An internal report for Parks Canada, Western Region. Internal Report.
- Brandon, L.V. 1965. Groundwater Hydrology and Water Supply in the District of Mackenzie, Yukon Territory, and Adjoining Parts of British Columbia. Geological Survey of Canada, Paper 64-39.
- Brown, I.C. 1967. Groundwater in Canada. Geol. Surv. Can., Econ. Geol. Rept. No. 24.
- Ceska, Adolf. December 1980. Hot Springs Vegetation Study. Report prepared for B.C. Hydro and Power Authority, Vancouver, B.C. 45pp.
- Clapp, C.H. 1914. Sharp Point Hot spring, Vancouver Island, B.C. Geol. Surv. Can. Summ. Rept. 1913.
- Clark, I.D., P. Fritz and F.A. Michel. 1980. Isotope Hydrogeology and Geothermometry of the Mt. Meager Geothermal Area. Prepared for Energy, Mines and Resources. University of Waterloo, Waterloo Research Institute. Project # 707-10-03.
- Clarke, A.H., 1976. The Endangered Molluscs of Canada. IN: Canada's Threatened Species and Habitats - proceeding of the Symposium on Canada's threatened Species and Habitats edited by T. Mosquin and C. Suchal, Ottawa, Ont.
- Cole, L., Heber 1930. The Salt Industry of Canada, Mines Branch, Dept. of Mines, Ottawa: Bull. No. 716.
- Coroici, W.J. and B.S. Prasand. 1977. Hydrogeology of the Canmore Corridor, Alberta. Groundwater Division, Alberta Research Council, Edmonton, Alberta. Misc. Report.

- Crandall, J.T., and T.L. Sadlier-Brown. 1978. Data on Geothermal Areas: Cordillera Yukon, N.W.T. and Adjacent B.C., Canada, Dept. of Energy Mines and Resources, Ottawa.
- Dennington, M. 1975. A Reconnaissance of the Coal River Springs, Yukon Territory for IBP-CT Panel 10. Misc. Report.
- Dolmage, Victor 1922. Coast and islands of British Columbia between Burke and Douglas Channels. Geol. Surv. Can., Summ. Rept., 1921, pt. A.
- Duffell, S., and Souther, J.G. 1964. Geology of Terrace map-area, B.C. Geol. Surv. Can., Mem. 329.
- Elworthy, R.T. 1918. Mineral Springs of Canada, Part 11, the chemical character of some Canadian mineral springs; Canada Dept. Mines Bull. 20 (Mines Br. No. 472).
- Elworthy, R.T. 1926. Hot springs in western Canada - their radioactive and chemical properties; Canada Dept. Mines, Mines Br., Inv. Mineral Resources and Mining Industry, 1925, Bull. 669.
- Gabrielse, H., Roddick, J.A. and Blusson, S.L., 1965. Flat River, Glacier Lake, and Wrigley Lake, District of Mackenzie and Yukon Territory. Geol. Survey of Canada. Paper 64-52, 30 p.
- Haites, T.B., 1959. Banff Thermal Springs, a fascinating problem. Jour. of the Alberta Society of Petroleum Geologists, vol. 7, no. 2.
- Harrington, L., 1970 - Hot Springs of Western Canada. Can. Geog. J. (2): 52-61.
- Holland, S.S., 1964. Landforms of British Columbia. A Physiographic Outline. Bulletin No. 48. B.C. Department of Mines and Petroleum Resources. Victoria, B.C.
- Kerr, F.A. 1948. Lower Stikine and western Iskut River areas, British Columbia. Geol. Surv. Can. Mem. 246.
- Leech, G.B. 1954. Canal Flats, British Columbia, Geol. Surv. Canada, Paper 54-7.
- MacDonald, J., D. Pollock and B. McDermot. 1978. Hotsprings of Western Canada - a complete guide. Labrador Tea Company, Vancouver, B.C. 162pp.
- McLean, F.H., and Kindle, E.D. 1950. Geology of northeastern British Columbia; Geol. Surv. Can., Mem. 259.
- Marsh, A. 1974. The botany and natural history of Middle Springs Swamp, Banff, Alberta. Canadian Field-Naturalist 88: 129-140.
- Marsh, A.H. and Scotter, G.W. 1974. Vegetation Survey and Development Recommendations for the Rabbitkettle Area, Nahanni National Park. Canadian Wildlife Service.
- Marsh, A.H. and Scotter, G.W. 1975. Vegetation Survey and Impact Assessment of the Nahanni Hot Springs and Virginia Falls Area. Parks Canada.

- Moise, B. 1983. Coal River Springs: Yukon's Hidden Paradise. *Canadian Geographic* 103(5): 18-25.
- Nelson, J.S. 1982. The Tropical Fish Fauna in Cave and Basin Hotspring Drainage, Banff National Park. *Canadian Field-Naturalist* 96.
- Nevin, A.W., 1975. Report on Detailed Geothermal Investigation at Meager Creek, Prepared on Behalf of B.C. Hydro.
- Paquet, R. 1964. Mineral Waters of Quebec. *Canadian Mining and Metall. Bull.* 57:629. p. 939-944. Tables.
- Pavlick, L.E. 1974. Liard River Hotsprings Park: An Interpretation. Vol. 3. B.C. Provincial Parks Interpretation Series. Dept. of Recreation and Conservation. Victoria. 99 pp.
- Porsild, A.E. and H.A. Crum. 1961. The Vascular Flora of Liard Hotsprings, B.C., with Notes on some Bryophytes. *Nat. Museum Canada, Ottawa, Bulletin* 171:131-197.
- Raufs, H.M. 1934. Phytogeographic studies in the Peace and upper Liard River regions, Canada. *Contr. Arnold Arboretum* VI:1-230.
- Raup, Hugh M. 1947. The Botany of Southwestern Mackenzie. *Sargentia* 6: 276p.
- Reid, T.C. 1976. An Investigation of the Possible Relationship Between Boreal Vascular Floras and Hypsithermal Relict Vegetation. Mimeo. B.C. Parks Branch, Victoria. 119 pp.
- Reid, T.C. April 1978. Vegetation and Environment Patterns of Liard River Hot Springs Provincial Park, British Columbia. M.Sc. Thesis, Simon Fraser University.
- Reynolds, W.D. 1976. A Report on Cave and Basin Research. Parks Canada, Western Region. Internal Report.
- Scotter, G.W. and W.J. Cody, 1979. Interesting Vascular Plants from Southeastern Yukon Territory. *Canadian Field-Naturalist* 93(2): 163-170.
- Souther, J.G., 1980. Geothermal Reconnaissance in the Central Garibaldi Belt, B.C. In *Current Research, Part A, Geological Survey of Canada, Paper 80-1A*: 1-11.
- Souther, J.G. and E.C. Halstead. 1973. Mineral and thermal waters of Canada. Geological Survey of Canada. Dept. of Energy, Mines and Resources. Paper 73-18.
- van Everdingen, R.O. 1978. Sulfur Mountain Hotsprings - Storyline Document.

- van Everdingen, R.O. 1973. Thermal and Mineral Springs, Nahanni National Park, District of Mackenzie, N.W.T. Environment Canada. Water Resources Branch. Environment Canada. Calgary, Alta. Report N73-10.
- van Everdingen, R.O., 1972, Thermal and Mineral Springs In the Southern Rocky Mountains of Canada, Water Management Service, Department of the Environment, Ottawa, Canada.
- van Everdingen, R.O., 1970. The Paint Pots, Kootenay National Park, British Columbia - acid spring water with extreme heavy-metal content. Can. Journal Earth Sci. Vol. 7(3), p.831 - 852.
- van Everdingen, R.O. 1970. Seasonal Variations, Sulfur Mountain Hot Springs, Banff, Alberta. Tech. Bull. No. 33. Inland Waters Branch Energy, Mines and Resources Canada, Ottawa.
- Wallis, C. and C. Wershler. 1981. Natural History Inventory and Assessment in the Many Springs Area - Bow Valley Park. Alberta Energy and Natural Resources, Fish and Wildlife Division.
- Waring, G.A. 1965. Thermal springs of the United States and other countries of the world - a summary; U.S.G.S. Prof. Paper 492.

APPENDIX A
INVENTORY OF MINERAL SPRINGS
FOUND IN CANADA

SPRING #:1

NAME: FISHELLS BROOK

GENERAL

Location: Fishells Brook and Saint Vintans, Nfld. (4 springs)

Ownership: no data

Access: road

Human Impact: area exploited for salt production during the early 1900's.

General Description: four springs issue from fault zones within gypsum bearing Codroy group bedrock.
Formerly used for the production of salt.

PHYSICAL CHARACTERISTICS

Temperature (°C): 7-10°C

Volume (l/min): series of small seeps

Total dissolved Solids (ppm):relatively high

pH: no data

Chemical Constituents (ppm): NaCl, CaSO₄

Gaseous Constituents (ppm):

H₂S

General Character of Water: brine springs

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: area destroyed as a result of development of the salt industry

Exceptional Features:

REFERENCES Souther and Halstead (1973); Cole (1930)

SPRING #:2

NAME: ORANGEDALE

GENERAL

Location: 2 km west of Orangedale in Inverness County

Ownership: no data

Access: road

Human Impact: none

General Description: a small saline spring occurs along a small creek. Gas bubbles are present

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): 4 l/min

Total dissolved Solids (ppm): 32,600

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: a brine spring with a high salt content. Calcium also present

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation is destroyed around the spring seeps

Exceptional Features:

REFERENCES Cole (1930)

SPRING #:3

NAME: CAPE BRETON ISLAND

GENERAL

Location: Whycocomeagh, N.S.

Ownership: no data

Access: road

Human Impact: none

General Description: three springs issue from the base of an escarpment composed of Carboniferous rock, which includes limestone, gypsum, rock salt and anhydrite directly in St. Patrick Channel. These springs have the largest flow of any in the Appalachian Region.

PHYSICAL CHARACTERISTICS

Temperature (°C): 6°C

Volume (l/min): 400 l/min

Total dissolved Solids (ppm): 3,300

pH: no data

Chemical Constituents (ppm): Na, Cl

Gaseous Constituents (ppm):

General Character of Water: brine spring with a low mineral content

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no interesting flora is expected because of the low mineral content

Exceptional Features:

REFERENCES Souther and Halstead (1973); Cole (1930)

GENERAL

Location: Bucklaw, N.S.

Ownership: no data

Access: road

Human Impact: small salt evaporating process (2 pots) was present

General Description: one spring issues from Carboniferous rocks including limestone, gypsum, rock salt and anhydrite. An area of about 6 ha of flat marshy land is present.

PHYSICAL CHARACTERISTICS

Temperature (°C): 13°C

Volume (l/min): 140 l/min

Total dissolved Solids (ppm): 58,300

pH: no data

Chemical Constituents (ppm): Na, Cl

Gaseous Constituents (ppm): H₂S odor

General Character of Water: brine spring with a very high mineral content

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation is destroyed by the high salt content and high hydrated iron peroxides formed.

Exceptional Features:

REFERENCES Souther and Halstead (1973); Cole (1930)

SPRING #:5

NAME: GLENDYER

GENERAL

Location: near Glendyer station on the Inverness railroad

Ownership: no data

Access: road

Human Impact: none

General Description: several springs flow from brown limestone of the Windsor series. No further information.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): 30-40 l/min.

Total dissolved Solids (ppm): 32,500

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: brine spring

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES Cole (1930)

SPRING #: 6

NAME: BADDECK

GENERAL

Location: 5 km east of Baddeck, Victoria county

Ownership: no data

Access: road

Human Impact: no data

General Description: there are two springs on the north side of the Baddeck-Ross Ferry highway. The springs are found in a meadow swale with a number of seeps near the high tide level along Baddeck Bay.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): 10 l/min

Total dissolved Solids (ppm): 32,600-50,000

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: a brine spring with a high salt content

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the salt plant (Sarcocornia spp.) is present immediately adjacent to the spring at its outflows. Lush meadow is found above these low-lying flats

Exceptional Features:

REFERENCES Cole (1930)

SPRING #: 7

NAME: ETHERIDGE

GENERAL

Location: near Salt Springs P.O., Antigonish County

Ownership: private

Access: road

Human Impact: none

General Description: two small springs are present, one occurs on the east bank of the West River, while the other forms several small saline ponds.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm): 21,300 to 44,100

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: brine spring with gas discharge

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES Cole (1930)

SPRING #: 8

NAME: POMQUET RIVER

GENERAL

Location: located 2 km south of the Antigonish-Mulgrave highway

Ownership: no data

Access: road

Human Impact: none

General Description: a small seep with no appreciable flow maintains a small pool of about 100 m².
The bottom is soft black muck and if disturbed has a strong H₂S odor.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): small

Total dissolved Solids (ppm): 18,800

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no vegetation surrounds this small seep

Exceptional Features:

REFERENCES Cole (1930)

SPRING #: 9

NAME: POMQUET INTERVALE

GENERAL

Location: located 4 km upstream of where the Antigonish-Medgrave highway crosses the Pomquet River

Ownership: no data

Access: road

Human Impact: none

General Description: the spring area covers 10 m² with the spring coming up through gravels along with a slight gas discharge. The gravel is iron stained

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): 1 l/min

Total dissolved Solids (ppm): 40,700

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: brine spring

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES Cole (1930)

SPRING #: 10

NAME: DUNMORE

GENERAL

Location: located 2 km west of Dunmore, Antigonish county

Ownership: no data

Access: road

Human Impact: none

General Description: little information except a number of saline ponds are found

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): very small

Total dissolved Solids (ppm): 8,000

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: brine spring with a low mineral content

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES Cole (1930)

GENERAL

Location: located near Antigonish, Nova Scotia along a small creek that runs near the southeastern portion of the town.

Ownership: no data

Access: road

Human Impact: area exploited for salt production during the early 1900's.

General Description: A group of springs emerge from a large marshy area underlain by limestone, gypsum, rock salt and anhydrite.

PHYSICAL CHARACTERISTICS

Temperature (°C): 9°C

Volume (l/min): 2 l/min

Total dissolved Solids (ppm): 37,700

pH: no data

Chemical Constituents (ppm): Na, Cl

Gaseous Constituents (ppm): H₂S

General Character of Water: brine spring
Appalachian region.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES Souther and Halstead (1973); Cole (1930)

SPRING #: 12

NAME: BRIERLY BROOK

GENERAL

Location: located 4 km west of Antigonish on the north side of Briery Creek

Ownership: Private

Access: Road

Human Impact: none

General Description: the spring occurs at the west end of a shallow pond at the base of a low escarpment

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): 20 l/min

Total dissolved Solids (ppm): 65,500

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: brine spring with a very high salinity

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES Cole (1930)

GENERAL

Location: located about 2 km south of Kempton, Colchester county

Ownership: no data

Access: road

Human Impact: none

General Description: a very small brine spring with little information on its characteristics. It is said to seep from steeply dipping rocks on the east bank of a small creek.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): very small

Total dissolved Solids (ppm): 28,800a

pH: no data

Chemical Constituents (ppm): Na, Cl

Gaseous Constituents (ppm):

General Character of Water: brine spring

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES Souther and Halstead (1973); Cole (1930)

GENERAL

Location: located on the west bank of West River south of Salt Springs, Pictou County

Ownership: Private

Access: Road

Human Impact: a well and small basin evaporating operation occurred in the 1920's

General Description: a series of small springs occurring at river level

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: brine spring

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES Cole (1930)

GENERAL

Location: Oxford District, N.S. (9 springs)

Ownership: no data

Access: road

Human Impact: several of the springs have been tested for the production of salt in the early 1950's

General Description: a series of nine springs emerge from bedrock composed of limestone, gypsum, rock salt and anhydrite. Most are small seeps.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): 2-8 l/min.

Total dissolved Solids (ppm): 7100-74,000

pH: no data

Chemical Constituents (ppm): Na, Cl

Gaseous Constituents (ppm):

General Character of Water: brine springs

Exceptional Features: the springs near Salt Springs, Cumberland County have the highest salinity of any spring in the Appalachian Region.

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES Souther and Halstead (1973); Cole (1930)

GENERAL

Location: Windsor District, N.S. (6 springs)

Ownership: no data

Access: road

Human Impact: none

General Description: a series of six springs occurring in a marshy area underlain by limestone, gypsum, rock salt and anhydrite.

PHYSICAL CHARACTERISTICS

Temperature (°C):

Volume (l/min): small seeps to 60 l/min.

Total dissolved Solids (ppm): 6,000-24,300

pH: no data

Chemical Constituents (ppm): Na, Cl SO₄

Gaseous Constituents (ppm):

General Character of Water: brine springs with a moderate mineral content

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES Souther and Halstead (1973); Cole (1930)

GENERAL

Location: Sussex, New Brunswick - Kings County

Ownership: no data

Access: road

Human Impact: area exploited for salt production during the early 1900's.

General Description: several springs emerge from the Moncton basin and are related to anticlinal structures that appear to be the result of thrust faulting with salt accumulation and doming on the upthrow side.

PHYSICAL CHARACTERISTICS

Temperature (°C): 7 °C

Volume (l/min): 12 l/min.

Total dissolved Solids (ppm): 44,500

pH: no data

Chemical Constituents (ppm): Na, Cl

Gaseous Constituents (ppm):

General Character of Water: brine spring with a high mineral content

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation of the area has been disturbed as a result of salt production in the early 1900's

Exceptional Features:

REFERENCES Souther and Halstead (1973); Cole (1930)

GENERAL

Location: Salina, N.B.

Ownership: no data

Access: road

Human Impact: area exploited for salt production during the early 1900's.

General Description: a spring of relatively low volume emerging from limestone, gypsum, rock salt and anhydrite rock types.

PHYSICAL CHARACTERISTICS

Temperature (°C): 11°C

Volume (l/min): 24 l/min.

Total dissolved Solids (ppm): 19,600

pH: no data

Chemical Constituents (ppm): Na, Cl, SO₄

Gaseous Constituents (ppm):

General Character of Water: brine spring with a relatively low mineral content.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation of the area has been largely destroyed by past salt industry development.

Exceptional Features:

REFERENCES Souther and Halstead (1973); Cole (1930)

GENERAL

Location: located near the town of South Bolton in Brant County

Ownership: private

Access: road

Human Impact: a health resort occupied the site until 1934 when it burned down. No major development has taken place since then.

General Description: Little information exists on the characteristics of this spring. It is known that it issues from flat-lying sedimentary rocks composed of limestone, shale, dolomite and sandstone.

PHYSICAL CHARACTERISTICS

Temperature (°C): 10.0°C

Volume (l/min): 4 l/min.

Total dissolved Solids (ppm): 135

pH: no data

Chemical Constituents (ppm): HCO₃(123), Cl(14), SO₄(4), SiO₂(10), Ca(24), Mg(6), Na(17), K(1)

Gaseous Constituents (ppm): H₂S(5)

General Character of Water: the water is lightly mineralized sulphurous type with a marked taste of hydrogen sulphide.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the natural vegetation was destroyed with the construction of the health resort

Exceptional Features:

REFERENCES Paquet (1964)

GENERAL

Location: Champlain Co., Quebec near St. Maurice

Ownership: Private

Access: road

Human Impact: area developed as a bottled water facility

General Description: the spring is enclosed in a concrete well about 100m from the shoreline of Lake St. John

PHYSICAL CHARACTERISTICS:

Temperature (°C): 9°C

Volume (l/min): 80 l/min

Total dissolved Solids (ppm): 1888

pH: no data

Chemical Constituents (ppm): Cl(869), Na(478), HCO₃(224), SO₄(105), SiO₂(12), Ca(97), Mg(57), K(14)

Gas Constituents (ppm): CO₂(6.3 ppm)

General Character of Water: the water is a moderately mineralized chloro-bicarbonate sodic type.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation has been destroyed by development

REFERENCES: Paquet (1964); Elworthy (1918); Souther and Halstead(1973)

GENERAL

Location: St. Genevieve de Batiscan, Quebec

Ownership: Private

Access: road

Human Impact: area developed as a bottled water facility

General Description: the spring issues from a complex of limestone, dolomite, shale, and some sandstone beds.

PHYSICAL CHARACTERISTICS:

Temperature (°C): 8°C

Volume (l/min): 32 l/min

Total dissolved Solids (ppm): 29,260

pH: no data

Chemical Constituents (ppm): Cl(14,677), Na(9,090), HCO₃(1,123), I(7), Br(34), SO₄(3),
SiO₂(11), Ca(290), Mg(891), K(282)

Gas Constituents (ppm): H₂S(trace), CO₂

General Character of Water: a sodium-chloride-bicarbonate type with very high levels of Cl and Na

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation of the area has been destroyed by the mineral water facility

REFERENCES: Paquet (1964); Elworthy (1918); Souther and Halstead(1973)

GENERAL

Location: located in Maskinonge County, Quebec

Ownership: Private

Access: road

Human Impact: no data

General Description: the spring rises in a small pool at the foot of the steeply sloping bank of the River Maskinonge, about 40 meters from the river's edge.

PHYSICAL CHARACTERISTICS:

Temperature (°C): 8°C

Volume (l/min): small

Total dissolved Solids (ppm): 6185

pH: no data

Chemical Constituents (ppm): Cl(2826), Na(1872), HCO₃(1075), WO₃(49), SiO₂(19), Ca(49), Al(4),
Mg(123), K(145)

Gas Constituents (ppm):

General Character of Water: a sodium chloride type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

REFERENCES: Elworthy (1918)

SPRING #:23

NAME: AETNA SPRING

GENERAL

Location: located at St. Severe, Quebec

Ownership: Private

Access: road

Human Impact: the spring has been developed as a bottled water facility

General Description: no information

PHYSICAL CHARACTERISTICS:

Temperature (°C): 8°C

Volume (l/min): small

Total dissolved Solids (ppm): 17946

pH: no data

Chemical Constituents (ppm): Cl(9400), Na(5729), HCO₃(1955), SiO₂(37), Ca(71), Al(10),
Mg(473), K(167), Fe(4) SO₄(3), NO₂(29)

Gas Constituents (ppm):

General Character of Water: a sodium chloride type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation destroyed by development

REFERENCES: Elworthy (1918)

GENERAL

Location: Maskinonge Co., Quebec along the west bank of Riviere-du-Loup about 2 km east of St. Leon

Ownership: Private

Access: road

Human Impact: area developed; once site of a health resort

General Description: several springs emerge from the west bank of Riviere-du-Loup from unfolded Palaeozoic sedimentary rocks of limestone, shale, dolomite and sandstones.

PHYSICAL CHARACTERISTICS:

Temperature (°C): 11.7°C.

Volume (l/min): 5 l/min

Total dissolved Solids (ppm): 13,796

pH: no data

Chemical Constituents (ppm): Cl(7,213), Na(4,250), HCO₃(1,675), SO₄(2), SiO₂(32), Ca(126),
Mg(423), K(155)

Gas Constituents (ppm): H₂S(2ppm)

General Character of Water: the water is a strongly mineralized chloro-bicarbonated sodic type.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation has been destroyed by development

REFERENCES: Paquet (1964); Elworthy (1918); Souther and Halstead(1973)

GENERAL

Location: located about 2 km north of St. Hyacinthe

Ownership: Private

Access: road

Human Impact: area developed as a bottled water facility

General Description: the spring emerges from unfolded Palaeozoic sedimentary rocks composed of limestone, dolomite, shale and sandstone.

PHYSICAL CHARACTERISTICS:

Temperature (°C): 8.6°C

Volume (l/min): 4 l/min

Total dissolved Solids (ppm): 4790

pH: no data

Chemical Constituents (ppm): Cl(19433), Na(1485), HCO₃ (1,130), SO₄(20), SiO₂(15), Ca(55), Na(1485) K(51),

Gas Constituents (ppm):

General Character of Water: the water is moderately mineralized chloro-bicarbonated sodic type.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation has been destroyed by development

REFERENCES: Paquet (1964)

GENERAL

Location: located in Maskononge County, Quebec about 9 km farther up the Riviere-du-Loup from St. Leon Spring.

Ownership: Private

Access: road

Human Impact: area developed as a bottled water facility

General Description: there are two springs 2 meters apart along the Riviere-du-Loup that rise from the Hudson River formation.

PHYSICAL CHARACTERISTICS:

Temperature (°C): 8.3°C

Volume (l/min): small

Total dissolved Solids (ppm): 13,746

pH: no data

Chemical Constituents (ppm): Cl(6495), Na(4029), HCO₃ (2320), SiO₂(31), Ca(286), Na(4029)
K(197), Mg(307), NH₄(30)

General Character of Water: a sodium chloride type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation has been destroyed by development

REFERENCES: Elworthy (1918)

GENERAL

Location: located about 4 km south of the town of Chambly.

Ownership: Private

Access: road

Human Impact: area developed as a bottled water facility and the spring is now enclosed in a cement pit

General Description: the spring emerges at the base of a ridge composed of a complex of limestone, dolomite, shale and sandstone. The ground around the spring is marshy.

PHYSICAL CHARACTERISTICS

Temperature (°C): 9°C

Volume (l/min): 4 l/min.

Total dissolved Solids (ppm): 2,077

pH: no data

Chemical Constituents (ppm): Na(748), Cl(518), SO₄(1), SiO₂(22), Ca(10), Mg(19), K(2)

Gaseous Constituents (ppm):

General Character of Water: the water is a moderately mineralized chloro-bicarbonated sodic type.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation has been destroyed by development

Exceptional Features:

REFERENCES Paquet (1964), Elworthy (1918); Souther and Halstead (1973)

GENERAL

Location: Abenakis Springs, Quebec is located about 4 km west of the village of St. Francois du Lac,
Yamaska county

Ownership: Private

Access: road

Human Impact: area developed as a bottled water facility

General Description: presently two springs issue from the unfolded Palaeozoic sedimentary rocks into two concrete buildings

PHYSICAL CHARACTERISTICS

Temperature (°C): 11.5°C

Volume (l/min): 12-16 l/min.

Total dissolved Solids (ppm): 14,298

pH: no data

Chemical Constituents (ppm): Cl(7,522), Na(4,285), HCO₃(588), SO₄(754), SiO₂(19), Ca(479),
Mg(293), K(95)

Gaseous Constituents (ppm): CO₂(3ppm)

General Character of Water: the water is strongly mineralized of a murlated sodic type.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the area has been destroyed by development

Exceptional Features:

REFERENCES Paquet (1964), Elworthy (1918); Souther and Halstead (1973)

GENERAL

Location: located about 1 km northeast of Oka monastery, between St. Joseph du Lac and Oka.

Ownership: Private

Access: road

Human Impact: area developed as a bottled water facility

General Description: no information

PHYSICAL CHARACTERISTICS

Temperature (°C): 9°C

Volume (l/min): 40 l/min.

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the area has been destroyed by development

Exceptional Features:

REFERENCES Paquet (1964)

GENERAL

Location: located at St. Benoit, Two Mountains Co., Quebec.

Ownership: Private

Access: road

Human Impact: a wooden house has been built around spring and water used to be bottled.

General Description: the spring rises in a well with the overflow running to a creek about 200m away.

PHYSICAL CHARACTERISTICS

Temperature (°C): 10.5°C

Volume (l/min):small

Total dissolved Solids (ppm): 5263

pH: no data

Chemical Constituents (ppm): SO₄(116), HCO₃(109), NO₃(2), CL(3062), SiO₂(8), AL(6), Ca(148), Mg(140), K(44), Na(1606)

Gaseous Constituents (ppm): CO₂(22)

General Character of Water: the water is moderately mineralized, sodic mineralized water of a saline type.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation around the spring has been destroyed.

Exceptional Features:

REFERENCES: Elworthy (1918)

GENERAL

Location: Varennes Spring, Quebec 2 km north of village of Varennes In Vercheres county

Ownership: Private

Access: road

Human Impact: area developed as a bottled water facility

General Description: the two springs percolate from unfolded sedimentary rocks in a complex of limestone, dolomite, shale and sandstones.

PHYSICAL CHARACTERISTICS

Temperature (°C): 8.6°C

Volume (l/min): no data

Total dissolved Solids (ppm): 11,220

pH: no data

Chemical Constituents (ppm): Cl(6,060), Na(3,858), HCO₃(1285), SO₄(2), SiO₂(16), Ca(100),
Mg(200), K(85)

Gaseous Constituents (ppm): CO₂(3ppm)

General Character of Water: the water is a strongly mineralized chloro-bicarbonated sodic type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the area has been destroyed by development

Exceptional Features:

REFERENCES Paquet (1964), Elworthy (1918); Souther and Halstead (1973)

GENERAL

Location: located in the middle of the Bayonne River at Fernleville

Ownership: Private

Access: road

Human Impact: a wooden tub has been built around the spring.

General Description: the spring flows from the middle of the Bayonne River
limestone, dolomite, shale and sandstones.

PHYSICAL CHARACTERISTICS

Temperature (°C): 8.0°C

Volume (l/min): no data

Total dissolved Solids (ppm): 6868

pH: no data

Chemical Constituents (ppm): Cl(3171), Na(2202), HCO₃(1218), SiO₂(35.5), Al(5), Ca(31),
Mg(146), K(3),

Gaseous Constituents (ppm):

General Character of Water: the spring is a sodium chloride type.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: none

Exceptional Features:

REFERENCES: Elworthy (1918)

GENERAL

Location: located near the village of La Providence, St. Hyacinthe

Ownership: Private

Access: road

Human Impact: the spring is enclosed in a wooden casing 3 meters deep.

General Description: no data

PHYSICAL CHARACTERISTICS

Temperature (°C): 9.4°C

Volume (l/min): small

Total dissolved Solids (ppm): 2987

pH: no data

Chemical Constituents (ppm): HCO₃(1369), SO₄(2), NO₂(5), Cl(643), SiO₂(15), Al(11), Ca(7),
Mg(11), K(29), Na(889)

Gaseous Constituents (ppm): H₂S(1.2ppm)

General Character of Water: a sodium chloride type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation has been destroyed by development.

Exceptional Features:

REFERENCES: Elworthy (1918)

GENERAL

Location: located in a municipal park in the city of Joliette

Ownership: municipal park

Access: road

Human Impact: developed for public use

General Description: the water flows naturally from a borehole, 20 m deep, drilled in 1890.

PHYSICAL CHARACTERISTICS

Temperature (°C): 9°C

Volume (l/min): 16 l/min.

Total dissolved Solids (ppm): 298

pH: no data

Chemical Constituents (ppm): HCO₃, Ca, Fe, SO₄, Na, K.

Gaseous Constituents (ppm): H₂S(11.5)

General Character of Water: lightly mineralized with a very strong hydrogen sulfide taste

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora:natural vegetation destroyed by development

Exceptional Features:

REFERENCES:Paquet (1964)

GENERAL

Location: located on the bank of L'Achigan River, about 1 km east of L'Epiphanie, L'Assomption county

Ownership: private

Access: road

Human Impact: area developed for bottled water facility but not used now.

General Description: no data

PHYSICAL CHARACTERISTICS

Temperature (°C): 9°C

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: the water is a chloro-bicarbonate sodic and magnesium type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: vegetation destroyed by development

Exceptional Features:

REFERENCES: Paquet (1964)

GENERAL

Location: located along the shore of the St. Lawrence River near the village of St. Germain de
Kamouraska

Ownership: no data

Access: road

Human Impact: developed in the early 1900's as a bottled water facility.

General Description: the water emerges from limestone, dolomite and shale rocks at the base of a steep
cliff

PHYSICAL CHARACTERISTICS

Temperature (°C): 9°C

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no information

Exceptional Features:

REFERENCES: Paquet (1964)

GENERAL

Location: Carlsbad Springs, Ont. (sulphur) 7 saline springs) located 16 km from Ottawa.

Ownership: Private

Access: road

Human Impact: developed in the early 1900's as a health spa with bathing pools.

General Description: this group of springs was known as early as 1806 to the Ottawa Valley settlers. They issue from interbedded sedimentary rocks of the Chazy Group.

PHYSICAL CHARACTERISTICS

Temperature (°C): 8°-9°C

Volume (l/min): 65 l/min. (combined)

Total dissolved Solids (ppm): 3210

pH: no data

Chemical Constituents (ppm): Cl(1,390), Na(1,065), HCO₃(657)

Gaseous Constituents (ppm): CO₂(17 ppm), H₂S(2ppm)

General Character of Water: moderately mineralized springs of a sodium chloride type with a hydrogen sulphide odor.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the natural vegetation has been destroyed by development.

Exceptional Features:

REFERENCES: Elworthy (1918); Souther and Halstead (1973)

GENERAL

Location: near Ottawa in Carleton County

Ownership: private

Access: road

Human Impact: the area of the spring has been bricked up and enclosed in a wooden house

General Description: the spring rises in low lying marshy ground between two parallel ridges.

PHYSICAL CHARACTERISTICS

Temperature (°C): 10.5°C

Volume (l/min): no data

Total dissolved Solids (ppm): 10,952

pH: no data

Chemical Constituents (ppm): Cl(5,910), Na(3,740), HCO₃(954)

Gaseous Constituents (ppm): CO₂(22)ppm

General Character of Water: a sodium chloride type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the natural vegetation has been destroyed by development

Exceptional Features:

REFERENCES: Elworthy(1918); Souther and Halsted (1973)

GENERAL

Location: located in Carleton County near Ottawa

Ownership: private

Access: road

Human Impact: a well has been drilled

General Description: the water rises from the Chazy formation and a well has been drilled to increase flows.

PHYSICAL CHARACTERISTICS

Temperature (°C): 10°C

Volume (l/min): small

Total dissolved Solids (ppm): 9,887

pH: no data

Chemical Constituents (ppm): Cl(4,870), Na(3,044), HCO₃(1,410)

Gaseous Constituents (ppm):

H₂S(1ppm)

General Character of Water: a sodium chloride type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the natural flora has been destroyed by development.

Exceptional Features:

REFERENCES: Elworthy (1918, Souther and Halstead (1973)

GENERAL

Location: located in Lanark County, Ont.

Ownership: private

Access: road

Human Impact: the area of the spring has been cemented and covered.

General Description: the spring lies at the base of a hill about 50 m from the Madawaska River.

PHYSICAL CHARACTERISTICS

Temperature (°C): 9°C

Volume (l/min): 17 l/min.

Total dissolved Solids (ppm): 5,137

pH: no data

Chemical Constituents (ppm): Cl(2,537), Na(1,640), HCO₃(708)

Gaseous Constituents (ppm):

General Character of Water: a sodium chloride type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the natural vegetation has been destroyed by development

Exceptional Features:

REFERENCES: Elworthy (1918); Southerby and Elworthy (1917)

GENERAL

Location: located 4 km east of Ottawa

Ownership: Private

Access: road

Human Impact: a wooden well surrounds the spring area.

General Description: the spring flows from the bank of Green's creek.

PHYSICAL CHARACTERISTICS

Temperature (°C): 9°C

Volume (l/min): 16 l/min.

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: the spring emits a lot of H₂S gas.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the natural vegetation has been destroyed.

Exceptional Features:

REFERENCES: Elworthy (1918)

GENERAL

Location: Caledonia Springs, Ont. (3 saline springs)

Ownership: Private

Access: road

Human Impact: developed as a health spa in the early 1900's

General Description: these 3 springs were known as early as 1806 and were developed as health spas in the early 1900's. Artesian wells were drilled to augment the natural flows. The water flows from interbedded limestone and shale.

PHYSICAL CHARACTERISTICS

Temperature (°C): 8°C

Volume (l/min): 8 l/min.

Total dissolved Solids (ppm): 8,118

pH: no data

Chemical Constituents (ppm): Cl(4,194), Na(2,691), HCO₃(930)

Gaseous Constituents (ppm): CO₂(41 ppm), H₂S(1 ppm)

General Character of Water: moderately mineralized water with a distinct hydrogen sulphide odor.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the natural vegetation destroyed by development

Exceptional Features:

REFERENCES: Elworthy (1918); Souther and Halstead (1973)

SPRING #: 43

NAME: CHAMBORD

GENERAL

Location: located about 1 km east of the village of Chambord, Lac St. Jean County.

Ownership: Private

Access: road

Human Impact: area developed as a bottled water facility.

General Description: the spring is enclosed in a concrete well about 100m from the shoreline of Lake St. John.

PHYSICAL CHARACTERISTICS

Temperature (°C):

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH:

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: the water is very saline and bitter taste is apparently a chloro-sulphate calcic and sodic type. Must be diluted to drink.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation has been destroyed by development.

Exceptional Features:

REFERENCES: Paquet(1954)

SPRING #: 44

NAME: PINE RIVER

GENERAL

Location: located on Lake Winnipeg at the mouth of the Pine River

Ownership: Crown

Access: Road

Human Impact: It is possible some salt production took place during the 1920's

General Description: a series of three springs arise from deep till overlaying Devonian limestone; Large salt flats are present.

PHYSICAL CHARACTERISTICS

Temperature (°C): 9°C

Volume (l/min): 60 l/min (combined)

Total dissolved Solids (ppm): 33,626

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: brine spring

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the area is devoid of vegetation except for the salt plant (Sarcocornia spp)

Exceptional Features:

REFERENCES: Cole (1930); Brown (1965)

SPRING #: 45

NAME: LAKE WINNIPEG

GENERAL

Location: south end of Lake Winnipeg - Red Deer Peninsula, Manitoba

Ownership: Crown

Access: Road

Human Impact: It is possible some salt production has taken place

General Description: a series of three springs rising through flat-lying till deposits along Lake Winnipeg. They form large salt flats basically devoid of vegetation

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm): 40,066

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: brine spring

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the only plant present is Salicornia spp in the salt flat area

Exceptional Features:

REFERENCES: Cole (1930); Brown (1965); Souther and Halstead (1973)

GENERAL

Location: Salt Point-Dawson Bay, Manitoba

Ownership: Crown

Access: road

Human Impact: salt production occurred in the late 1800's

General Description: a series of four springs occurring in large salt flats devoid of vegetation. One spring discharges directly into Dawson Bay

PHYSICAL CHARACTERISTICS

Temperature (°C): 9°C

Volume (l/min): 300 l/min (combined)

Total dissolved Solids (ppm): 59,297

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: brine springs

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the areas are largely devoid of vegetation and some disturbed by salt production activities.

Exceptional Features:

REFERENCES: Cole (1930); Brown (1965)

SPRING #: 47

NAME: RED DEER RIVER, MANITOBA

GENERAL

Location: located at the mouth of the Red Deer River on Dawson Bay, Manitoba

Ownership: Crown

Access: road

Human Impact: possible salt production in the later 1800's

General Description: a series of three springs emerge from flat lying till deposits overlying Devonian Limestone. Large salt flats up to 50 hectares devoid of vegetation are present. Small saline ponds are present in these flat areas.

PHYSICAL CHARACTERISTICS

Temperature (°C): 10°C

Volume (l/min): 44 l/min (combined)

Total dissolved Solids (ppm): 51,899

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: brine springs

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: areas have been disturbed by past salt production

Exceptional Features:

REFERENCES: Cole (1930)

SPRING #: 48

NAME: SALT RIVER

GENERAL

Location: located on the bank of the Salt River between Athabaska and Great Slave Lakes.

Ownership: Crown

Access: boat

Human Impact: none

General Description: seven or eight springs issue from the base of a long ridge of Devonian Limestone and gypsum and deposit into a large basin devoid of vegetation. These salt flats are 6-8 km in width.

PHYSICAL CHARACTERISTICS

Temperature (°C): 4.4°C

Volume (l/min): 16 l/min.

Total dissolved Solids (ppm): 260,000

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: brine spring

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the only plant present near the springs and on the salt flats is Sarcocornia rubra.

Exceptional Features:

REFERENCES: Cole (1930), Allan (1929)

GENERAL

Location: located at La Saline, 42 km north of McMurray, Alberta

Ownership: Crown

Access: boat

Human Impact: none

General Description: the springs occur about 200m from the Athabaska River and form a large lake that varies in size depending on the season. The area around the lake is devoid of vegetation but further back lush marsh meadows are present. Tufa deposits have been reported to be extensive.

PHYSICAL CHARACTERISTICS

Temperature (°C): 8°C

Volume (l/min): 30 l/min

Total dissolved Solids (ppm): 70,000

pH: no data

Chemical Constituents (ppm): Na Cl

Gaseous Constituents (ppm):

General Character of Water: brine springs

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the salt flats are devoid of vegetation, but further back bush marsh meadows are present

Exceptional Features:

REFERENCES: Cole (1930), Allan (1929)

SPRING #: 50

NAME: BIG HILL

GENERAL

Location: located just outside Big Hill Springs Provincial Park, northwest of Calgary.

Ownership: Alberta Parks and Recreation Access: road/trail.

Human Impact: none

General Description: little information is known on this spring except that extensive travertine deposits occur at the spring and along Big Hill Creek.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data Volume (l/min): large

Total dissolved Solids (ppm): no data pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: no data

Exceptional Features: extensive travertine deposits.

BIOLOGICAL CHARACTERISTICS

Flora: no unique flora has been reported although the area surrounding the spring and its outflow channel contains a number of wetland plant species. Most notable are Parnassia palustris, Mentha arvensis, and Ranunculus circinatus.

Exceptional Features:

REFERENCES: D. Klelau (pers. comm.)

GENERAL

Location: located 80 km west of Calgary on the eastern edge of the Rocky Mtns. In Alberta.

Ownership: Bow Valley Provincial Park

Access: road/trail

Human Impact: none

General Description: the Many Springs basin occurs in the western extremity of the park adjacent to the Bow River. The springs discharge from about the 1286 metre contour level and form a large calcareous "fen" containing twelve distinctive plant communities. The combined flow of the springs are high with seasonal fluctuations. Discharge is by outflow channel to the Bow River.

PHYSICAL CHARACTERISTICS

Temperature (°C): 5°C

Volume (l/min): 4000 (combined)

Total dissolved Solids (ppm): 284

pH: no data

Chemical Constituents (ppm): Cl(8), SO₄(85), HCO₃(152), Na(1), Ca(70), Mg(22), NO₃(1)

Gaseous Constituents (ppm): no data

General Character of Water: a calcium bicarbonate type with a generally low TDS value.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the calcareous spring area is significant in biological resources with numerous rare plant species, a diversity of breeding birds and moderate ungulate use. A total of 159 species of vascular plants have been recorded. Seventy-two percent are calcicoles. There is an abundance of orchid species especially Cypripedium passerinum. Fourteen plant species are considered rare in Alberta including the only known occurrence in Canada of Cypripedium calceolus.

Fauna: the diversity of habitats leads to a large number of breeding birds (25). Elk, deer and moose utilize the area yeararound.

Exceptional Features: exceptionally diverse flora with a large number of rare and threatened species.

REFERENCES: Kuhn (pers. comm.); Walls and Wershler (1981); Cerolci and Prasad (1977).

GENERAL

Location: located on Canmore Creek approximately 2.5 km west of its confluence with the Bow River.
Follow road from Canmore to the Spray Lakes, stopping just past crossing of Canmore Creek.
Take the trail on north side of Canmore Creek.

Ownership: crown land - Alberta

Access: road/short trail (1 km)

Human Impact: none

General Description: two small springs issue from talus deposits that obscure the limonitic sandstones from which the springs emerge - no pool or travertine deposits are present.

PHYSICAL CHARACTERISTICS

Temperature (°C): 6.1° C.

Volume (l/min): very small 9 l/min.

Total dissolved Solids (ppm): 1135

pH: 7.2

Chemical Constituents (ppm): Ca(198), Sr(14.5), Mg(82), Na(9), K(2), HCO₃(233), SO₄(695), Cl(4),
SiO₂(15)

Gaseous Constituents (ppm): H₂S, CO₂

General Character of Water: Clear and tasteless

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no detailed vegetation studies; however the emergence from talus at low temperature would limit the development of characteristic or unique spring vegetation

No wildlife usage recorded

Exceptional Features:

REFERENCES: Van Everdingen (1972)

GENERAL

Location: Spray River valley at foot of Mt. Fortune

Ownership: Banff National Park

Access: road, trail from Banff Springs Hotel

Human Impact: none

General Description: a group of springs on river bank creating a marshy area

PHYSICAL CHARACTERISTICS

Temperature (°C): cold (2.8 - 3.1°C)

Volume (l/min): no data

Total dissolved Solids (ppm): 1697

pH: 7.7

Chemical Constituents (ppm): Ca(310), Mg(115), HCO₃(54.9), SO₄(1164) Na(30.9), SiO₂(15)
K(1.8), Cl(33.5)

General Character of Water: strong H₂S smell with waters of a calcium sulphate type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data on the vegetation of these springs but because the spring waters are cold, typical marsh plants such as sedges would be expected.

Mineral lick and watering area

Exceptional Features:

REFERENCES: Van Everdingen (1972)

SPRING #: 54

NAME: PANTHER RIVER

GENERAL

Location: southeast bank of Panther River, 7 km from Park boundary

Ownership: Banff National Park

Access: road, 8 km trail

Human Impact: none

General Description: 2 springs in mixed talus and alluvial deposits covering bedrock. No travertine deposits are present.

PHYSICAL CHARACTERISTICS

Temperature (°C): cold 2.7-3.0°C

Volume (l/min): 45 l/min (combined)

Total dissolved Solids (ppm): 1146

pH: 7.4

Chemical Constituents (ppm): Ca(222), Mg(85), HCO₃(294), SO₄(643), Na(17.2), SiO₂(10.8),
WO₃(12), Cl(10),

Gaseous Constituents (ppm): H₂S, CO₂

General Character of Water: faint H₂S smell; clear and tasteless

Exceptional Features: highest sulphur springs known - 1794 m

BIOLOGICAL CHARACTERISTICS

Flora: no detailed vegetation studies have been completed although it has been reported that lush algae and bacteria colonies are present. The marsh area contains a variety of plant communities.

No wildlife usage recorded

Exceptional Features:

REFERENCES: Van Everdingen (1972)

SPRING #: 55

NAME: INK POTS

GENERAL

Location: Johnston Creek valley, 6.4 km from bridge on Hwy. 1A

Ownership: Banff National Park

Access: Marked trail

Human Impact: none

General Description: the springs are situated on the north bank of Johnston Creek about 90 m from the creek. Seven ponds each with one or more spring outlets occur in a subalpine meadow/bog habitat. The ponds range in size from 3m to 30m in diameter. Air bubbles and spring water emerge from the bottom of these ponds and lead to quicksand conditions. The flow of water continues throughout the winter.

PHYSICAL CHARACTERISTICS

Temperature (°C): 3.1° - 4.8°

Volume (l/min): 1800 l/min (combined)

Total dissolved Solids (ppm): 253

pH: 7.5

Chemical Constituents (ppm): Ca(52.2), Mg(20), HCO₃(183), SO₄(80), Na₃(4.5), SiO₂(4)

Gaseous Constituents (ppm): CO₂

General Character of Water: greenish, milky appearance of water in ponds due to the suspension of fine silt particles.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no characteristic plant species or communities are expected. However, the subalpine environment and diversity of habitats are expected to create a high floristic diversity and variety of plant communities.

No wildlife usage recorded although it is possible that wildlife use the springs since it remains open during the winter months.

Exceptional Features:

REFERENCES: Van Everdingen (1972)

GENERAL

Location: near Williams Lake along the Fraser River on the Dog Creek Road at Mile 37

Ownership: Crown land

Access: road

Human Impact: none, some trampling by cattle

General Description: 2 springs - one with tufa dome lined with a red-banded wall - one has formed small pool in a depression

PHYSICAL CHARACTERISTICS

Temperature (°C): 8.0°C

Volume (l/min): small

Total dissolved Solids (ppm): no data

pH: 6.3

Chemical Constituents (ppm): no data

General Character of Water: clear, odorless, epsom salt taste. Red oxide deposit at stream outlet

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the spring occurs in rugged, dry sagebrush country and provides a lush vegetation habitat for a wide variety of shrubs and herb species. No unique plants are known.

Cattle and wildlife mineral lick.

Exceptional Features:

REFERENCES: MacDonald et al (1978)

SPRING #: 57

NAME: RISKE CREEK

GENERAL

Location: 7 km west of Riske Creek along the Chilcotin Highway, then north 1.9 km from the B.C. Forest Service station.

Ownership: Private

Access: road

Human Impact: none

General Description: the spring "bolls" from the centre of a tufa dome well. The dome rises 0.5m and has a 3m base.

PHYSICAL CHARACTERISTICS

Temperature (°C): 8 °C

Volume (l/min): small

Total dissolved Solids (ppm): no data

pH: 6.23

Chemical Constituents (ppm): no data

General Character of Water: cloudy, odorless, turbid, CO₂ gas discharge - boiling effect

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no information exists on the type of vegetation communities surrounding this mineral spring.

Mineral lick for wildlife.

Exceptional Features:

REFERENCES: MacDonald et al (1978)

SPRING #:58

NAME: KOCH CREEK

GENERAL

Location: 19.5 km west of Passmore along a logging road from the B.C. Hydro substation

Ownership: Crown land

Access: logging road

Human Impact: none

General Description: seep in rock face - water collects in small depressions in tufa and evaporates - mineral deposits which are left are used as licks by game

PHYSICAL CHARACTERISTICS

Temperature (°C): cold

Volume (l/min): seep

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

General Character of Water: very strong mineral taste; gas bubbling from cracks in rocks

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no information on the vegetation characteristics is available but it is expected that little vegetation of interest would be present because of the low volume and steep rock habitat.

Mineral lick for wildlife

Exceptional Features:

REFERENCES: MacDonald et al (1978)

SPRING #: 59

NAME: Mt. Meager

GENERAL

Location: 120 km north of Vancouver on the north of south flanks of Mt. Meager

Ownership: crown

Access: logging road

Human Impact: none

General Description: approximately 14 known cold springs occur on the north and south slopes of Mt. Meager at elevations between 550 and 1875m. Most are associated with tributary streams to Meager Creek and Lillooet River. Some springs are precipitating tufa especially those with a high calcium content. One spring has formed a tufa deposit 20m in diameter below its vent with terraced pools.

PHYSICAL CHARACTERISTICS

Temperature (°C): range from -0° to 9°C

Volume (l/min): no data

Total dissolved Solids (ppm): 97,809

pH: 5.92-8.3

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: the springs generally have a very low mineral content with calcium and bicarbonate the most common chemical constituents.

Exceptional Features: the spring known as "CaCO₃" between Boundary and No Good Creek has exceptionally well developed terraced pools and intricate channels.

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES: Clark et al (1980)

SPRING #: 60

NAME: FERNWOOD

GENERAL

Location: Salt Spring Island, B.C.

Ownership: crown

Access: boat and road

Human Impact: none

General Description: a spring flows from Cretaceous shaly sandstones; precipitates sodium chloride and sodium sulphate over 300' diam.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): 8 l/min

Total dissolved Solids (ppm): 71,926

pH: no data

Chemical Constituents (ppm): Cl(27,440), Na(25,240), SO₄(17,520)

Gaseous Constituents (ppm):

General Character of Water: brine spring

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES: Cole (1930), Souther and Halstead (1973)

SPRING #: 61

NAME: KWINITSA

GENERAL

Location: located at the confluence of the Kwinitse and Skeena Rivers about 77 km west of Prince Rupert, B.C.

Ownership: Private

Access: road

Human Impact: area developed in the early 1900's for the production of salt. In 1913, 15 tons of salt were extracted by boreholes. No present development activity exists.

General Description: a series of springs issue from Pleistocene and Recent silty clay deposits. Sea water intrusion is responsible for high sodium chloride discharge.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm):

pH: no data

Chemical Constituents (ppm): NaCl

Gaseous Constituents (ppm):

General Character of Water: brine spring

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no vegetation exists around the springs as a result of development and high sodium chloride content

Exceptional Features:

REFERENCES: Cole (1930); Souther and Halstead (1973)

SPRING #: 62

NAME: MOORE CREEK

GENERAL

Location: located in northwestern B.C. on Moore Creek

Ownership: crown land

Access: helicopter

Human Impact: none

General Description: the spring issues fractures in late Tertiary Naylorite forming terraced deposits of psilometane and pyrolusite in thick 6m diam.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): MnO₂

Gaseous Constituents (ppm):

no data

General Character of Water:

"

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no information on the vegetation surrounding this spring

Exceptional Features:

REFERENCES: Cole (1930); Souther and Halstead (1973)

APPENDIX B
INVENTORY OF THERMAL SPRINGS
FOUND IN CANADA

SPRING #: 1

NAME: SKOOKUMCHUK

GENERAL

Location: Skookumchuk, 20 miles nw of Douglas and 54 km south of Mt. Currie Village.

Ownership: Private Lot #1747

Access: rough road 54 km from Mt. Currie village.

Human Impact: B.C. Forest Service campsite with picnic tables, wooden bathtub. This area is heavily used by the public and is deteriorating rapidly.

General Description: hot spring percolates from gravels below the road - water flows along a flume to bathtub; cold water pipe to adjust temperature.

PHYSICAL CHARACTERISTICS

Temperature (°C): 54°C

Volume (l/min): 62 l/min.

Total dissolved Solids (ppm): 1280

pH: 8.05

Chemical Constituents (ppm): SO₄(413), Ca(163), Cl(338), Na(119)

Gaseous Constituents (ppm):

General Character of Water: sodium sulphate type; lightly mineralized sulphur present; clear, sulphur smell and taste.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: The area has been altered drastically as a result of previous homesteading and the present B.C. Forest Service campsite. A lush meadow of grasses (Agrostis spp., Phleum pratense, Calamagrostis spp. and Holcus lanatus), Cattails (Typha latifolia) and weedy species including poison ivy is present near the outlet. Large areas devoid of vegetation are common.

No wildlife usage recorded.

Exceptional Features:

REFERENCES MacDonald et al (1978)

Waring (1965); Souther and Halstead (1973)

SPRING #: 2

NAME: FRANK CREEK

GENERAL

Location: 16 km south of Skookumchuck on Frank Creek, then 2.4 km up the south side of Frank Creek.

Ownership: Crown

Access: Road and trail

Human Impact: None

General Description: Little information exists on this spring. It is said to be a cool spring (<25°C) with large flows. Tufa deposits are reported around the vent.

PHYSICAL CHARACTERISTICS

Temperature (°C): Cool

Volume: Large

Total dissolved Solids (ppm): No data

pH: No data

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: No information on the vegetation, although the low temperature of the springs would not be expected to create unique vegetation environments.

No wildlife usage recorded.

Exceptional Features:

REFERENCES MacDonald et al (1978)

SPRING #:3

NAME: CLEAR CREEK

GENERAL

Location: head of Clear Creek, 36 km north of Harrison Hotsprings on east side of Harrison Lake

Ownership: Crown land

Access: logging road, 10 km trail

Human Impact: cabin, cedar log swimming pool

General Description: the spring percolates from the ground at the head of Clear Creek, the spring now flows into a large cedar log swimming pool

PHYSICAL CHARACTERISTICS

Temperature (°C): 35°C

Volume (l/min): 110 l/min.

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water: clear, sulphur taste

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation near the hotsprings has been destroyed by development

No wildlife usage recorded

Exceptional Features:

REFERENCES: Macdonald et al (1978)

SPRING #:4

NAME: SLOQUET CREEK

GENERAL

Location: bank of Sloquet Creek, 16 km. above junction with Lillooet River

Ownership: timber leases CANFOR Lot #4664

Access: logging road and trail

Human impact: natural bathing pool along Sloquet Creek, but minimal disturbance

General Description: the spring percolates from sedimentary strata and forms a 0.5m stream that flows for 10 m before cascading over a 4.5 m high waterfall. The spring then flows for another 30 m to the Sloquet Creek. A pool for bathing has been constructed along the Sloquet Creek.

PHYSICAL CHARACTERISTICS

Temperature (°C): 68°C

Volume (l/min): 153 l/min.

Total dissolved Solids (ppm): 742

pH:8.9

Chemical Constituents (ppm): SO₄(360), Cl(63), Na(108), Ca(94)

Gaseous Constituents (ppm): H₂S

General Character of Water: clear, sulphur odour and taste

Exceptional Features: Hotsprings flows over a 4.5m waterfall, one of the hottest in Canada

BIOLOGICAL CHARACTERISTICS

Flora: the spring outlet and stream banks are covered with a dense growth of poison ivy

No wildlife usage recorded

Exceptional Features:

REFERENCES:Waring (1969); MacDonald et al (1978), Souther and Halstead (1973); S. Houseknecht (pers. comm.)

SPRING #:5

NAME: MEAGER CREEK

GENERAL

Location: 120 km. n.w. of Pemberton

Ownership: timber lease - MacMillan Bloedel; Access: logging road
presently being explored by B.C. Hydro for geothermal power

Human Impact: one large spring dammed for bathing - exploration by B.C. Hydro as Geothermal energy source

General Description: these Meager Creek springs comprise a group of more than 30 springs and seeps that issue from coarse gravel deposits on the southeast bank of Meager Creek about 6 km. from its confluence with the Lillooet River. These springs occur over an approximately 7 km. stretch of the Creek but are grouped in three areas

PHYSICAL CHARACTERISTICS (Main vent)

Temperature (°C) variable - 40° - 50°C

Volume (l/min): variable - 120 to 2400 l/min.

Total dissolved Solids (ppm): 1848ata

pH: 6.54

Chemical Constituents (ppm): Ca(82), Mg(26), Na(439), K(46), SiO₂(162), SO₄(122), Cl(528),
HCO₃(443)

Gaseous Constituents (ppm): no data

General Character of Water: clear, odourless, tasteless; algae in spring pools and overflow channels; spring water of a sodium chloride type.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: algae growing in the spring pools and overflow channels are the major vegetation in this coarse gravel area

No wildlife usage recorded

Exceptional Features:

REFERENCES: MacDonald et al (1978); Lewis and Souther (1978); Clark et al (1980)

GENERAL

Location: on Lillooet River 3 km north of mouth of Meager Creek

Ownership: Crown

Access: logging road

Human Impact: none

General Description: the springs issue from a high bank 30 m back from the Lillooet River and flow into small pools which are depositing thick calcite tufa. The stream which flows from these pools is lined with tufa and ochre-colored precipitate of iron oxide. This area is heavily forested around the main springs.

PHYSICAL CHARACTERISTICS

Temperature (°C): 59.8

Volume (l/min): no data

Total dissolved Solids (ppm): 1679

pH: 6.88

Chemical Constituents (ppm): Ca(33), Mg(5), Na(426), K(14), SiO₂(79), SO₄(288), Cl(83),
HCO₃(763)

Gaseous Constituents (ppm):

General Character of Water: the spring water is a Na₂CO₃ type

Exceptional Features: lava flow covering old river gravels where springs are found

BIOLOGICAL CHARACTERISTICS

Flora: no information exists on the vegetation of this springs other than mosses surround the pools and stream channel. The presence of pools, tufa and high spring temperatures would indicate the possible development of characteristic plant communities. Of special interest is the activity of toads and apparent breeding in these spring pools during February when the adjacent terrain is covered with a 1 metre of snow (J. Souther, pers. comm.)

Exceptional Features:

REFERENCES: MacDonald et al (1978); Lewis and Souther (1978); Clark et al (1980); J. Souther (pers. comm.)

GENERAL

Location: 20 km north of Pitt Lake

Ownership: Lot #2170 - private B.C. Forest Products Access: boat then trail

Human Impact: occasional use by loggers in the area

General Description: hot spring flows from a crevice in rock face 2.4m above river, channel along rock face ends in small pool between cliff and river

PHYSICAL CHARACTERISTICS

Temperature (°C): 57.3°C

Volume (l/min): 3 l/min.

Total dissolved Solids (ppm): No data

pH: no data

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water: clear, odourless, strong mineral taste

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: Little vegetation cover is present other than algae in the stream channel as a result of the steep rock cliff and coarse gravel along the river.

No wildlife usage recorded.

Exceptional Features: None

REFERENCES MacDonald et al (1978)

SPRING #:8

NAME: HARRISON (SULPHUR)

GENERAL

Location: Harrison, near S. end of Harrison Lake (Sulphur)

Ownership: private

Access: Trans Canada Highway

Human Impact: tourist resort

General Description: two springs percolate from the gravels on the shore of Harrison Lake, about .8km down a path from the resort hotel, a concrete pavillion has been built around the springs to protect it from lake flooding. The waters are then piped to the hotel.

PHYSICAL CHARACTERISTICS

Temperature (°C): 62.0°-68.0°C.

Volume (l/min): 1528 l/min.

Total dissolved Solids (ppm): 1332

pH: 8.11-8.38

Chemical Constituents (ppm): NaCl(473), Na₂SO₄(452), CaSO₄(278), SiO₂(59), Ca(HCO₃)₂(28), KCl(28), MgSO₄(13)

General Character of Water: moderately radioactive, lightly mineralized sulphur, clear, strong sulphur taste, strongly bubbling gas

Exceptional Features: none

BIOLOGICAL CHARACTERISTICS

Flora: the spring occurs in the lake gravels and is unvegetated because of the coarse gravel substrate and concrete structure surrounding the spring.

Exceptional Features:

REFERENCES: MacDonald et al (1978), Souther and Halstead (1973)

GENERAL

Location: 100 km north of Vancouver on Mt. Cayley

Ownership: one parcel - geothermal rights -
O'Brien Energy & Mines Ltd.

Access: helicopter

Human Impact: none

General Description: two groups of springs are present on Mt. Cayley. A group of three springs occur in upper Turbid Creek, while a group of two springs are found in upper Shovelnose Creek. The thermal springs are depositing tufa and sinter. The springs are relatively inaccessible and require rock climbing to reach. All occur above 1500 metres.

PHYSICAL CHARACTERISTICS

Temperature (°C): 28.8°C

Volume (l/min): no data

Total dissolved Solids (ppm): 5503

pH: 5.99

Chemical Constituents (ppm): Ca(483), Mg(159), Na(968), K(76), Fe(6.4), Mn(1), SiO₂(90), SO₄(1180)
HC₃(1470)

General Character of Water: clear with a very high mineral content; predominantly Na₂CO₃ type.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no information on the vegetation exists. However, it is possible that these springs could contain interesting flora because of their altitude and warm spring temperatures.

Exceptional Features:

REFERENCES: Souther (1980); Clark et al(1978)

GENERAL

Location: south end of Matilda Inlet; 1.6 km south of Marktosis

Ownership: Lot #1241, Gibson Marine Provincial Park Access: water taxi from Tofino, trail (1 km.)

Human Impact: cement swimming pool

General Description: the spring percolates from the ground into a cement swimming pool. Water cool in comparison to the other springs.

PHYSICAL CHARACTERISTICS

Temperature (°C): 25°C

Volume (l/min): 11 l/min.

Total dissolved Solids (ppm): no data

pH: 9.45

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water: "

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation has been completely destroyed

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: Sharp Point between Sydney Inlet and Refuge Cove on the west side of Vancouver Island

Ownership: Maquinna Provincial Park

Access: plane or boat; 1 mile trail from wharf

Human Impact: heavily used by the public, fishermen and native Indians. Several companies charter group trips.

General Description: the spring flows from fractured diorite and over a 3m waterfall 23m from the source. The spring flows into three large bathtub-size tidal pools that are partially flooded by the incoming tide. This dilutes the very hot water.

PHYSICAL CHARACTERISTICS

Temperature (°C): 50.0°C

Volume (l/min): 440 l/min.

Total dissolved Solids (ppm): 483

Chemical Constituents (ppm): Cl(217); Ca(20); Na(137), Mg(1); SO₂(59); K(2); SO₄(47)

Gaseous Constituents (ppm): H₂S; CO₂

General Character of Water: Clean, with a sulphur taste and smell and a strong bubbling gas discharge. The water has a high sodium chloride content, probably as a result of contamination by sea water.

Exceptional Features: Waterfall and tidal pools surrounded by steep rock wall are exceptional

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation of the area is densely vegetated by an undergrowth of salal. Along the hot springs channels monkeyflower (Mimulus guttatus) and a thicket carpet of mosses are present. Yellow cedar and Sitka spruce are the common tree species.

No wildlife usage recorded

Exceptional Features:

REFERENCES: Clapp(1914); Souther and Halstead (1973); MacDonald et al (1978)

GENERAL

Location: 1.5 km from Fair Harbour on Kyuquot Sound, Vancouver Island

Ownership: Crown

Access: boat

Human Impact: none

General Description: Fissured granitic rock; several small pools. Little information exists on ;this small hotsprings.

PHYSICAL CHARACTERISTICS

Temperature (°C): Hot

Volume (l/min):no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES: Clapp(1914); Souther and Halstead (1973); Waring (1965)

GENERAL

Location: Several springs occur along the Kiinikiini River and up Hoodoo Creek

Ownership: Crown land

Access: logging road

Human Impact: none

General Description: one spring flows into 6th lake on Kiinikiini R., two springs along Hoodoo Creek, one spring near Franklin Glacier

PHYSICAL CHARACTERISTICS

Temperature (°C): 58°C.

Volume (l/min): 88 l/min

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water: clear, odourless and tasteless

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: little information exists on the vegetation surrounding the springs in this area. However, given the influence of the coastal climate, no unusual vegetation types are expected.

No wildlife usage recorded

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: shore of Nascall Bay in Dean Channel

Ownership: private lot #1594

Access: boat, plane

Human Impact: boathouse with porcelain tub

General Description: springs percolates from ground on a steep and rocky hillside of granite diorite bedrock approximately 7.5m above high tide. Water is piped to porcelain tub.

PHYSICAL CHARACTERISTICS

Temperature (°C): 43°C.

Volume (l/min): 46 l/min

Total dissolved Solids (ppm): no data

pH: 9.04

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water: colourless, odourless, tasteless, lots of organic material in ;the bottom of the small pool

Exceptional Features: none

BIOLOGICAL CHARACTERISTICS

Flora: the spring issues from rocks in the middle of a dense scrub yellow cedar (Chamaecyparis nootkatensis) and western hemlock (Tsuga heterophylla) stand. The understory is dominated by salal.

No wildlife usage recorded

Exceptional Features: none

REFERENCES: MacDonald et al (1973)

GENERAL

Location: shore of Eucott Bay, west side of Dean Channel

Ownership: private

Access: boat, plane

Human Impact: plastic pipe from spring to large wooden bathtub in cabin. Area heavily used by boaters.

General Description: main spring issues from boulders at base of steep mountain slope 23m back from high tide. There are several other small seeps along the bay below the high tide line.

PHYSICAL CHARACTERISTICS

Temperature (°C): 54.0°C.

Volume (l/min): 634 l/min

Total dissolved Solids (ppm): 192

pH: 7.44 and 7.25

Chemical Constituents (ppm): SO₄(80), Na(16), Ca(35), Cl(8), HCO₃(33), Mg(trace), SiO₂(17), FeO + Al₂O₃(3)

Gaseous Constituents (ppm):

General Character of Water: calcium sulphate/bicarbonate type; a clear strong, disagreeable mineral taste; fluffy mineral crust covering the rocks in stream outlet.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation surrounding the springs largely destroyed by development and now a lot of muddy areas are present. Of greatest interest is the highly productive estuarine habitats of Eucott Bay. It is possible that the warm spring waters increase and diversify these estuarine habitats.

No wildlife usage recorded

Exceptional Features: exceptional example of estuarine ecosystems

REFERENCES: MacDonald et al (1973), Souther and Halstead (1973); J. Pojar (pers. com.)

GENERAL

Location: west side of Link Lake north of dam at Ocean Falls

Ownership: Crown

Access: boat

Human Impact: None

General Description: a small spring has been reported but very little information exists on its characteristics.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: located south of Bella Coola on Thorensen Creek about 10 km upstream from the Bella Coola river.

Ownership: Crown

Access: trail

Human Impact: None

General Description: several small springs coming from gravels along the creek

PHYSICAL CHARACTERISTICS

Temperature (°C): warm

Volume (l/min): small

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: area surrounded by dense devils club thickets

Exceptional Features:

REFERENCES: Waring (1965); MacDonald et al (1978)

GENERAL

Location: on Sheemahant River 1.6 km above Owekono Bay

Ownership: Crown

Access: boat/trail

Human Impact: None

General Description: small spring, although little information exists on its characteristics.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH:

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: mouth of Wash Wash River

Ownership: Crown

Access: boat

Human Impact: None

General Description: small spring at the mouth of the Wash Wash River. Little information exists on its characteristics.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora:

no data

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: head of South Bentinck Arm

Ownership: Crown

Access: boat

Human Impact: None

General Description: a warm spring with small flows, little data exists on its characteristics

PHYSICAL CHARACTERISTICS

Temperature (°C): warm

Volume (l/min): small

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora:

no data

Exceptional Features:

REFERENCES: MacDonald et al (1978); Waring (1965)

GENERAL

Location: shore of South Bentinck Arm, 40km south of Bella Coola along Hotsprings Creek.

Ownership: Crown Zellerbach pulp lease Lot #237 Access: boat, plane

Human Impact: rotted cabin and porcelain bathtub

General Description: sixteen springs of varying sizes occur along a 400m stretch of shoreline at the base of the mountain. Supposedly there is a 2m geyser when a minus tide occurs. Many of these springs occur below high tide.

PHYSICAL CHARACTERISTICS

Temperature (°C): 46-64°C.

Volume (l/min): 264 l/min.

Total dissolved Solids (ppm): no data

pH: 7.87-8.01

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water: colourless, odourless, tasteless; Sodium sulphate type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no information exists on the vegetation but because of the previous development and coastal environment, no unusual vegetation types are expected. Most of the springs occur very near the high tide mark, bubble across algae covered beach gravel.

Exceptional Features:

REFERENCES: MacDonald et al (1978); Waring (1965); Souther and Halstead (1973)

GENERAL

Location: Weewanie Creek on Devastation Channel south of Kitimat.

Ownership: Crown

Access: boat, logging road.

Human Impact: a bathhouse is located at the spring

General Description: chloritic schist; two small springs are present, one flows from a fracture in the rocks 50m back from the high tide, while the other occurs further uphill.

PHYSICAL CHARACTERISTICS

Temperature (°C): 47.5°C.

Volume (l/min): 60 l/min.

Total dissolved Solids (ppm): 1229

pH: no data

Chemical Constituents (ppm): SO₄(546), Na(259), Cl(60), HCO₃(167), K(29), SiO₂(90), Mg(5),
Ca(67), FeO + Al₂O₃(5)

Gaseous Constituents (ppm):

General Character of Water: sodium sulphate type, clear, odourless and tasteless

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation near the hot springs has been destroyed by development. However, it is expected that the vegetation before development was typical of coastal B.C. and not exceptional.

No significant wildlife usage recorded.

Exceptional Features:

REFERENCES: MacDonald et al (1978); Waring (1965); Souther and Halstead (1973); Dolmage (1922)

GENERAL

Location: near southeast bank of Brim R., 200 m above mouth

Ownership: Crown

Access: boat

Human Impact: none

General Description: fissured quartz diorite; a very small spring that is flooded by high tides.

PHYSICAL CHARACTERISTICS

Temperature (°C): 38°C.

Volume (l/min): small

Total dissolved Solids (ppm): 281

pH: no data

Chemical Constituents (ppm): SO₄(78), Na(43), Cl(52), HCO₃(40), Mg(12), Na(43)
Ca(17), FeO + Al₂O₃(3), SiO₂(36)

Gaseous Constituents (ppm):

General Character of Water: sodium sulphate type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: this spring issues from an intertidal area along Brim River. It is a rocky area largely devoid of vegetation although a heavy growth of blue-green algae is present near the spring outlet.

Exceptional Features:

REFERENCES: MacDonald et al (1978); Waring (1965); Souther and Halstead (1973); Dolmage (1922)

GENERAL

Location: located on Hot Springs Cove on the north side of Gardner Canal.

Ownership: Crown

Access: boat

Human Impact: none

General Description: several springs issue from fractured grano-diorite between 3m below and 3m above high tide.

PHYSICAL CHARACTERISTICS

Temperature (°C): 45°C.

Volume (l/min): 484 l/min.

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water: Clear and odorless with a slight sulphur or mineral taste at some of the vents.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no exceptional vegetation. The springs are surrounded by very dense salal (Gaultheria shallon). Blue-green algae is present in the small outlet pools.

No wildlife usage recorded.

Exceptional Features:

REFERENCES: MacDonald et al (1978); Dolmage (1922)

GENERAL

Location: west side of Bishop's Cove on Ursula Channel

Ownership: Provincial Park reserve

Access: boat

Human Impact: spring flow dammed by cement wall and piped into a 3m x 3m concrete bathhouse site maintained by Kitimat Yacht Club

General Description: the spring issues from fissured quartz diorite into concrete bathhouse.

PHYSICAL CHARACTERISTICS

Temperature (°C): 43.5°C.

Volume (l/min): 60 l/min.

Total dissolved Solids (ppm): 400

pH: no data

Chemical Constituents (ppm): SO₄(179), Na(92), CO₃(7), SiO₂(65), HCO₃(4), Cl(32), Mg(0.3), Ca(18), FeO + Al₂O₃(5)

Gaseous Constituents (ppm): "

General Character of Water: sodium sulphate type clear, odourless, tasteless

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation near the hot springs has been destroyed by development. However, it is expected that the vegetation before development was typical of coastal B.C. and not exceptional.

No wildlife usage recorded.

Exceptional Features:

REFERENCES: MacDonald et al. (1978); Souther and Halstead (1973), J. Pojar (Pers. Comm.); Waring (1965).

GENERAL

Location: head of Klekane Inlet off Fraser Reach

Ownership: Crown land

Access: boat

Human Impact: used for bathing by loggers and fishermen;
maintained by Kitimat Yacht Club

General Description: Four small springs occur in the river delta to form a small creek 1.0m wide which flows to high tide. One spring occurs below high tide while the others issue from a fracture in the granite diorite bedrock.

PHYSICAL CHARACTERISTICS

Temperature (°C): 45° C.

Volume (l/min): 264 l/min.

Total dissolved Solids (ppm): 8640

pH: no data

Chemical Constituents (ppm): SO₄(717), Na(2523) CO₃(7), Cl(4600), HCO₃(58), Mg(179), K(82)
Ca(385), FeO + Al₂O₃(58)

Gaseous Constituents (ppm):

General Character of Water: sodium chloride type - similar to seawater contamination at depth. Clear, odourless, tasteless - some sulphur smell

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the springs occur in dense brush along the Klekane River. Dense shrubs dominate. Salmonberry (Rubus spectabilis) and grasses (Calamagrostis spp.) are the common vegetation types. Monkeyflower (Mimulus guttatus) is common. Green algae is found in the stream outlets.

Exceptional Features:

REFERENCES: MacDonald et al(1978); Souther and Halstead (1973)

GENERAL

Location: shore of Ursula Channel 4km north of Fisherman Cove

Ownership: Crown

Access: boat

Human Impact: none

General Description: quartz diorite; a very small spring issuing at the juncture of the intertidal and bedrock cliff.

PHYSICAL CHARACTERISTICS

Temperature (°C): 44° F.

Volume (l/min): small

Total dissolved Solids (ppm): 395

pH:

Chemical Constituents (ppm): SO₄(174), Na(81) CO₃(10), Cl(24), HCO₃(2), Mg(13),
Ca(22), FeO + Al₂O₃(23)

Gaseous Constituents (ppm):

General Character of Water: sodium sulphate type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: a dense growth of salal (Gaultheria shallon) surrounds the spring where it comes out of the rocks. Little other vegetation present.

Exceptional Features:

REFERENCES: Souther and Halstead (1973)

GENERAL

Location: shore of Brynildsen Inlet on Labouchere Channel

Ownership: Crown land

Access: boat

Human Impact: none

General Description: very small spring issuing from a fracture in granite diorite bedrock.

PHYSICAL CHARACTERISTICS

Temperature (°C): warm

Volume (l/min): small

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES:Waring (1965)

GENERAL

Location: located on the south bank of the Skeena River about 50km east of Prince Rupert.

Ownership: private (Lot #6449)

Access: boat

Human Impact: A small resort was built in 1928 but has not been used since 1930.

General Description: the four springs are located 30m up from the Skeena River. Two of the springs are now piped. The four springs form one creek about 1m wide that flows into the Skeena River. This area of the Skeena is still under the tidal influence.

PHYSICAL CHARACTERISTICS

Temperature (°C): 46°C.

Volume (l/min): 915 l/min.

Total dissolved Solids (ppm): no data

pH: 7.86

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water: Clear, odorless and tasteless

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation pattern has been altered by the development that took place in the 1930's. Thickets of salmonberry (Rubus spectabilis) surround the springs. Where the hot spring creek flows into the Skeena River, tidal vegetation such as Carex lyngbyi and Deschampsia caespitosa are found.

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: southeast corner of Lakelse Lake 16 km south of Terrace

Ownership: private resort

Access: highway

Human Impact: Resort hotel - bathing facilities (now closed) most springs affected by development.

General Description: quartz diorite, 9 springs flowing from swampy areas near Highway 25.

PHYSICAL CHARACTERISTICS

Temperature (°C): 52°C - 73.5°C.

Volume (l/min): 457 l/min.

Total dissolved Solids (ppm): 1109.6

pH: 7.96, 6.52

Chemical Constituents (ppm): Ca(46.6), Mg(50.2), Na(320.6), HCO₃(43.6), CO₃(2.3), SO₄(457.2), Cl(215.9), F(3.3), SiO₂(5.6), Fe(18.2), P(8.2), Li(10.2)

Gaseous Constituents (ppm):

General Character of Water: sodium sulphate, clear, odourless, tasteless, continuous gas discharge (probably CO₂)

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: The vegetation surrounding these hot springs has been severely disturbed by development. Most areas consist of black muck with typical coastal vegetation species in surrounding undisturbed areas. Area of coastal muskeg is present near the springs.

No significant wildlife usage recorded.

Exceptional Features:

REFERENCES: MacDonald et al (1978), Souther and Halstead (1973); Waring (1965); J. Pojar (Pers. Com.)

GENERAL

Location: Hotspring Island - 80 km s.e. of Queen Charlotte City

Ownership: Moresby Forest Reserve recreational Access: boat
area Lot #632

Human Impact: 7.5cm pipe funnels water into bathtub in rough shelter - used by local people,
fishermen and kayakers.

General Description: the springs are located on a 12ha island. Fifteen springs and seeps occur along an 80m stretch of the southwest corner of the island, above and below high tide. Two small pools collect the waters from several of the seeps, a pipe funnels the water from one of the pools into a bathtub in a rough shelter.

PHYSICAL CHARACTERISTICS

Temperature (°C): 52.5-76°C

Volume (l/min): 153 l/min.

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): H₂S

General Character of Water: clear, odourless, strong mineral taste, gas discharge

Exceptional Features: sandy beach nearby

BIOLOGICAL CHARACTERISTICS

Flora: the majority of the springs percolate from just above high tide and most of the area is unvegetated except for patches of blue-green algae.

Exceptional Features:

REFERENCES: MacDonald et al (1978), J. Pojar (Pers. Com.)

GENERAL

Location: 104km north of Terrace, off Nass Bay 1 km up Burton Creek

Ownership: Crown land

Access: road, boat

Human Impact: none

General Description: spring percolates from gravel in middle of small creek. Difficult to find. No pools.

PHYSICAL CHARACTERISTICS

Temperature (°C): 45°C

Volume: small

Total dissolved Solids (ppm): no data

pH: 6.62

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear, odourless, tasteless, minor gas discharge, minor mineral film on rocks in stream.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: Since the spring issues from stream gravels, no characteristic vegetation is present. Green algae on the rocks below spring outlet.

No wildlife usage recorded.

Exceptional Features:

REFERENCES:MacDonald et al (1978)

GENERAL

Location: 120 km n.w. of Terrace on the road to Greenville.

Ownership: Crown

Access: logging road

Human Impact: none

General Description: 4-6 springs in various sizes issue from exposed lava beds in an approximately 1 hectare area, several small pools about 1m in diameter are present.

PHYSICAL CHARACTERISTICS

Temperature (°C): 60°C

Volume (l/min): less than 60 l/min.

Total dissolved Solids (ppm): no data

pH: 8.1 SR

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear and tasteless

Exceptional Features: extensive exposed lava beds cover the area where the springs are found.

BIOLOGICAL CHARACTERISTICS

Flora: little vegetation information is available on this hot spring area. Presently most of the area is covered by a tall and dense cover of fireweed (Epilobium angustifolium).

No wildlife usage recorded.

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: east side of Stikine River, opposite Great Glacier, 8 km above confluence with Iskut River

Ownership: Crown land, Lot #85

Access: boat

Human Impact: none

General Description: 18 flows combined to form stream about 1 m in width; - springs issue from granitic rock wall at base of valley wall and in the mud along the Stikine River. The outlets are scattered along the wall for 75 meters.

PHYSICAL CHARACTERISTICS

Temperature (°C): 50° to 66°C.

Volume (l/min): 2800 l/min.

Total dissolved Solids (ppm): 880

pH: no data

Chemical Constituents (ppm): NaCl(423), CaSO₄(202), Na₂SO₄(154)

Gaseous Constituents (ppm): CO₂

General Character of Water: clear, odourless and tasteless

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no vegetation information exists on this spring, but its coastal climate, occurrence from coarse granite, lack of hot pools and proximity to the fluctuating water levels of the river limit the possible development of unique vegetation communities.

No wildlife usage recorded.

Exceptional Features:

REFERENCES: MacDonalld et al (1978), Souther and Halstead(1973)

GENERAL

Location: south end of Mess Lake

Ownership: Mt. Edziza Provincial Park

Access: helicopter or plane from EddontennaJon or Terrace

Human Impact: some geothermal exploration

General Description: the spring occurs in the middle of a flat-bottomed valley. The deposits left by this spring are large. A hill of travertine is present that measures 15m high and 30m wide. There are six other mounds of travertine 2m in diameter covering a 0.5ha area.

PHYSICAL CHARACTERISTICS

Temperature (°C): variable - approximately 41°C. Volume (l/min): very variable - Intermittent flows

Total dissolved Solids (ppm): no data

pH: 6.36

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): CO₂

General Character of Water: calcium bicarbonate with high iron content; slight sulfur odor and taste
Exceptional Features: Area of travertine covering 2 ha consisting of large and small mounds - visually outstanding.

BIOLOGICAL CHARACTERISTICS

Flora: No data but the recent volcanism, low spring temperatures and intermittent flows probably would decrease the prospect of encountering unique thermal spring vegetation.

Mineral lick used by moose.

Exceptional Features:

REFERENCES: MacDonald et al (1978), Souther and Halstead(1973)

SPRING #:35

NAME: SPHALER CREEK

GENERAL

Location: NTS mapsheet #104G - head of Sphaler Creek

Ownership: Mt. Edziza Provincial Park

Access: helicopter

Human Impact:

General Description: spring beside head of creek - no further information known

PHYSICAL CHARACTERISTICS

Temperature (°C):

Volume (l/min):

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: No data

Exceptional Features:

REFERENCES:MacDonald et al (1978)

GENERAL

Location: west side of Mess Creek valley, 8 km south of Mess Lake

Ownership: Crown land

Access: helicopter or plane from Terrace or Eddontenajon

Human Impact: exploration as a geothermal energy source has taken place

General Description: the spring percolates from the ground at the base of a limestone bluff on the west side of the Mess Creek valley. The spring forms a lake 23 m in diameter. A travertine deposit surrounds the lake.

PHYSICAL CHARACTERISTICS

Temperature (°C): 41.5°C.

Volume (l/min): unknown

Total dissolved Solids (ppm): no data

pH: 6.48

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear, sulphur smell, taste; thick scum of algae, small gas discharge

Exceptional Features: travertine deposits surrounding small lake

BIOLOGICAL CHARACTERISTICS

Flora: Mosses grow vigorously on the travertine deposit and are one of the factors in its development. In the vicinity of the springs, vegetation typical of thermal spring environments is present. Mimulus guttatus, Parnassia palustris, Erigeron philadelphicus and Plathenthera dilatata are dominant.

No wildlife usage recorded.

Exceptional Features: none

REFERENCES: MacDonal d et al (1978), Souther and Halstead (1973)

GENERAL

Location: head of Taweh Creek on northwest side of Mt. Edziza

Ownership: Mt. Edziza Provincial Park Access: helicopter from Eddontenajon

Human Impact: none

General Description: the spring is located along the creek and covers an area of about 150m with tufa and iron oxide

PHYSICAL CHARACTERISTICS

Temperature (°C): 43.5°C.

Volume (l/min): 45 l/min.

Total dissolved Solids (ppm): no data

pH: 6.30

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): CO₂

General Character of Water: calcium bicarbonate with high iron content. Clear, soda and mineral taste, soda smell, strong gas discharge.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: No data but the recent volcanism probably has not allowed characteristic vegetation communities to develop.

Mineral lick for moose.

Exceptional Features:

REFERENCES: MacDonald et al (1978), R. Heathman (pers. comm.)

GENERAL

Location: located on Elwyn Creek northwest of Mt. Edziza

Ownership: Mt. Edziza Provincial Park Access: helicopter

Human Impact: none

General Description: six springs (two warm, four cold) form three large pools at the head of Elwyn Creek. They flow over a cliff into the creek, forming large tufa deposits. One spring has formed a tufa basin 9m in diameter.

PHYSICAL CHARACTERISTICS

Temperature (°C): 25.0°C.

Volume (l/min): 234.5 l/min.; 1125 l/min (cold)

Total dissolved Solids (ppm): no data

pH: 6.79

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: cloudy with a slight mineral taste of a calcium bicarbonate type.

Exceptional Features: large travertine formations

BIOLOGICAL CHARACTERISTICS

Flora: No data but the low water temperatures and recent volcanism probably do not create habitats suitable for the development of characteristic or unique thermal spring plants or communities.

No wildlife usage recorded.

Exceptional Features:

REFERENCES: MacDonald et al (1978), R. Heathman (pers. comm.); Souther and Halstead (1973).

GENERAL

Location: Len King Creek, 6.5 km above confluence with Unuk River

Ownership: Crown Land

Access:

Human Impact: none

General Description: small warm spring flowing from gravels of Len King Creek

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH:

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: No data but not expected to have any significant biological characteristics because of location in creek bed.

Exceptional Features:

REFERENCES: MacDonald et al (1978)

SPRING #:40

NAME: ISKUT RIVER

GENERAL

Location: Iskut River approximately 16 km above the mouth of the Ningunsaw River

Ownership: Crown

Access: helicopter

Human Impact: none

General Description: small spring issuing from river gravels along the Iskut River. Covered by high flows on the Iskut River.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): slight H₂S odor

General Character of Water: no data

Exceptional Features: none

BIOLOGICAL CHARACTERISTICS

Flora: No vegetation near spring as it issues from river gravels and is covered during high flow periods.

Exceptional Features: none

REFERENCES: S. Houseknecht (pers. comm.)

GENERAL

Location: 16 km north of Sheslay, east side of river 610m elevation

Ownership: Crown Land

Access: helicopter

Human Impact: none

General Description: little information exists on this spring other than a report siting by helicopter pilot.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH:

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: no data

Exceptional Features: none

BIOLOGICAL CHARACTERISTICS

Flora: No data

Exceptional Features: none

REFERENCES: MacDonald et al (1978)

GENERAL

Location: located on the side of the hill about 1km south and east of Warm Bay on Atlin Lake.

Ownership: Crown Land

Access: road/trail

Human Impact: a small bathing pool has been dug out

General Description: one spring emerges at the site of an old homestead beside the trail to O'Donnel. The water bubbles up through sand and gravel into a small pool about 3m square. Another spring occurs 2 km farther up the trail and is known locally as "the Grotto". This spring emerges from a solution channel in a fold of the Cache Creek limestone formation.

PHYSICAL CHARACTERISTICS

Temperature (°C): 29°C; "the Grotto" - 9°C. Volume (l/min): 2700 l/min.

Total dissolved Solids (ppm): 226 pH: 7.7

Chemical Constituents (ppm): Ca(55), Mg(17), NA(2.6), HCO₃(253), SO₄(11), SiO₂(14)

Gaseous Constituents (ppm):

General Character of Water: calcium bicarbonate type with a low mineral content.

Exceptional Features: Interesting travertine terraces and small coves; some terraces where water flows over 5m drop.

BIOLOGICAL CHARACTERISTICS

Flora: No detailed vegetation descriptions exist, although it has been reported that watercress (Rorippa nasturtium-aquaticum) and green algae occur in the outflow channels. The occurrence of tufa in outflow channels could support typical thermal spring vegetation such as Mimulus guttatus, Parnassia palustris and Plethanthera dilatata.

Exceptional Features:

REFERENCES: MacDonald et al (1978); Brandon (1965); Souther and Halstead (1973)

GENERAL

Location: east side of Kootenay Lake on Crawford Creek, 2.5 km from Crawford Bay.

Ownership: Crown Land

Access: boat/trail

Human Impact: none

General Description: 2 small springs along Crawford Creek

PHYSICAL CHARACTERISTICS

Temperature (°C): 32°C

Volume (l/min):13 l/min.

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: No data, but do not expect thermophilic plant communities to form because of the low flows, location in river gravels, and relatively low spring temperatures.

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: 46.5 km north of Nelson on the Nelson-Kaslo Highway

Ownership: Private resort

Access: highway

Human Impact: retaining wall and large swimming pool

General Description: numerous springs seep along the shore of Kootenay Lake below the town of Ainsworth. The main outlet enters around a horseshoe cave, a former mine shaft that was abandoned when the miners struck hot water. Calcite has since coated the walls of the cave. A retaining wall now backs the cave and forms a large pool in the cave. The outlet cascades over the hill above the highway forming terraced travertine deposits.

PHYSICAL CHARACTERISTICS

Temperature (°C): 45-47.5°C.

Volume (l/min): 458 l/min.

Total dissolved Solids (ppm): 1766

pH: 5.9 and 6.5

Chemical Constituents (ppm): Ca(150), Mg(13.8), Na(290), Cl(63), SO₄(38), HCO₃(1144), Fe(1.3), SiO₂(67)

Gaseous Constituents (ppm): CO₂

General Character of Water: the water is clear and odorless with a strong sweet mineral taste. Carbon dioxide continuously bubbles out. The water is a sodium bicarbonate type.

Exceptional Features: terraced travertine deposits

BIOLOGICAL CHARACTERISTICS

Flora: No detailed data on flora exists but the terraced travertine deposit could contain interesting flora.

Exceptional Features:

REFERENCES: MacDonald et al (1978); Souther and Halstead (1973)

SPRING #:45

NAME: FRY CREEK

GENERAL

Location: located on the east side of Kootenay Lake on Fry Creek just above where Fry Creek flows into Carney Creek. From the lake to the spring is approximately 16 km.

Ownership: Crown land

Access: forest road and trail

Human Impact: none

General Description: this spring is reported to be small and flows from the gravels of Fry Creek.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): "

Gaseous Constituents (ppm): "

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: No data

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: 3.8 km west of Kaslo on New Denver Highway

Ownership: Crown Land

Access: road - New Denver Highway

Human Impact: none

General Description: spring flows from small tufa cave depositing tufa over 100m area - deposit truncated by Kaslo River (6m thick). Another spring depositing tufa about 0.5km away.

PHYSICAL CHARACTERISTICS

Temperature (°C): 10°C.

Volume (l/min): 300 l/min.

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear, soda taste, stream outlet rusty red from iron oxides

Exceptional Features: exceptional examples of large travertine deposits. One of the largest in B.C.

BIOLOGICAL CHARACTERISTICS

Flora: No data

No wildlife usage known.

Exceptional Features: none

REFERENCES: MacDonald et al (1978)

GENERAL

Location: located south from Nakusp to Box Lake then the logging road to Wilson Lake. Follow the road 8 km along the south shore of the lake to the first creek. Follow the creek a short distance to spring.

Ownership: Crown Land

Access: logging road

Human Impact: none

General Description: a small warm springs flowing from the bottom of a talus slide.

PHYSICAL CHARACTERISTICS

Temperature (°C): 30°C.

Volume (l/min): 30 l/min.

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: no data

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: No information on the vegetation characteristics, but its low temperature and small flow from a talus slope probably negates the development of unique plant communities.

No wildlife usage known.

Exceptional Features: none

REFERENCES: MacDonald et al (1978)

GENERAL

Location: 2.5 km up St. Leon Creek, east of Upper Arrow Lake

Ownership: private, Lot #1138

Access: logging road, trail

Human Impact: previously a resort but now back to natural state

General Description: three springs - one in small cave (1x2x3m deep) walls covered with calcite flow from rock fractures.

PHYSICAL CHARACTERISTICS

Temperature (°C): 49.0°C and 50°C

Volume (l/min): 122 l/min.

Total dissolved Solids (ppm): no data

pH: 7.63 and 8.10

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear, odourless, strong mineral taste

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: orange, pink and translucent green algae occur in the cave. The spring is surrounded by a young cedar/hemlock forest. No unique thermal spring vegetation species or communities are present, although deer fern (Blechnum sp. plant) has been reported surrounding the spring. This area is out of its normal range and it can be classed as a disjunct species.

Exceptional Features:

REFERENCES: MacDonald et al (1978); J. Wood (pers. comm.)

GENERAL

Location: 24km north of Nakusp on the Halfway River

Ownership: Crown Land

Access: logging road, trail

Human Impact: none

General Description: springs flow from river gravels covered at high water - smaller, hotter spring 23 m from river at base of rock outcrop.

PHYSICAL CHARACTERISTICS

Temperature (°C): 41.8°C to 60.5°C.

Volume (l/min): 152.7 l/min.

Total dissolved Solids (ppm): no data

pH: 7.14 and 7.87

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear and tasteless. Small, hot spring at rock outcrop has sulfur odor.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: No vegetation because springs issue from river gravels. Small algae colonies present.

No wildlife usage known.

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: located on the east shore of Upper Arrow Lake, 33.5 km north of Nakusp on the Nakusp-Revelstoke Highway.

Ownership: Lot #100 - privately owned

Access: road

Human Impact: the springs have been enclosed by concrete retaining walls.

General Description: three springs issue from the ground near the road. Each spring is enclosed by a concrete retaining wall. The combined flow is dammed 90 m downhill to form a small bathing pool.

PHYSICAL CHARACTERISTICS

Temperature (°C): 46.5°C to 50.5°C.

Volume (l/min): 308 l/min.

Total dissolved Solids (ppm): 788

pH: 7.8

Chemical Constituents (ppm): Ca(57), Na(161), SO₄(433), HCO₃(48)

Gaseous Constituents (ppm): N₂, CO₂, H₂S

General Character of Water: Strong sulfur taste and smell. The water is a sodium sulphate type.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the springs occur in a large open meadow but the thermal spring vegetation has been destroyed.

Fauna: very important mule deer and white-tailed deer winter range.

No wildlife usage recorded.

Exceptional Features:

REFERENCES: MacDonald et al (1978), Souther and Halstead (1973)

GENERAL

Location: near Nakusp on the east side of Upper Arrow Lake

Ownership: Provincial Park

Access: road

Human Impact: cement pools run by town of Nakusp

General Description: three springs flow from talus and combined flow pumped into swimming pool - another spring has footpool - large spring is source for new swimming pool.

PHYSICAL CHARACTERISTICS

Temperature (°C): 53 °C and 54.5°C.

Volume (l/min): 41 l/min.

Total dissolved Solids (ppm): 510

pH: no data

Chemical Constituents (ppm): CaSO_4 , NaCl, MgHCO_3

Gaseous Constituents (ppm):

General Character of Water: lightly mineralized sodium, calcium sulphate type. Clear with a mineral taste.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the hot spring area has been altered by development

Exceptional Features:

GENERAL

Location: 37 km east of Revelstoke on TransCanada Highway

Ownership: Private, but within Glacier National Park Access: trail

Human Impact: fully developed resort - original log pool boarded over

General Description: spring water piped down mountainside to resort pool - pool heated. The spring source occurs 2.5 km south of the highway.

PHYSICAL CHARACTERISTICS

Temperature (°C): 26°C Volume (l/min): 443 l/min.

Total dissolved Solids (ppm): no data pH: 7.49

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear, odourless and tasteless; reported low mineral content

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no detailed vegetation descriptions of this spring. Some destruction of the vegetation is expected by development. Watercress has been reported growing in the spring outlet.

Exceptional Features:

REFERENCES: MacDonald et al (1978); J. Wood (pers. comm.)

GENERAL

Location: located at the head of the Beaver Valley near the confluence of the Beaver River and Grizzly Creek in British Columbia.

Ownership: Glacier National Park

Access: trail

Human Impact: none

General Description: no information

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: no data

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES: J. Woods (pers. comm.)

GENERAL

Location: 13 km south of Fauquier to Octopus Creek, then follow the logging road up the mountainside to the 300m level. From here, walk 1.5km at the elevation to Octopus Creek. Proceed down the creek to the spring (approx. 300m.)

Ownership: Mt. Mista Provincial Park (Proposed) Access: logging road, trail

Human Impact: none

General Description: no data

PHYSICAL CHARACTERISTICS

Temperature (°C): 49°C

Volume (l/min): small

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear, sulphur odour, minor gas discharge, minor white mineral stain on rocks.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no information on the vegetation characteristics is available, however its small size probably negates the development of unique vegetation habitats.

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: northwest of Kimberley along the St. Mary's River, turn at Dewars Creek and follow the logging road to its end. Hike 16 km by trail.

Ownership: Crown land

Access: logging road and trail

Human Impact: unknown

General Description: little information exists on this spring. It is reported to have spectacular travertine cliffs.

PHYSICAL CHARACTERISTICS

Temperature (°C): 82.2°C.

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water:

Exceptional Features: large travertine cliffs

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

GENERAL

Location: west side of Upper Arrow Lake, 8 km nw of Burton

Ownership: Crown land

Access: highway, hike

Human Impact: unknown

General Description: spring flows from a 4cm diamond drill hole drilled by a prospector named Taylor.

PHYSICAL CHARACTERISTICS

Temperature (°C): 25°C.

Volume (l/min): 30 l/min

Total dissolved Solids (ppm): no data

pH: 8.44

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear, odourless, tasteless, minor gas discharge

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no unique vegetation characteristics

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: 5km east of Edgewood

Ownership: private farm

Access: access restricted

Human Impact: spring contained in barrel - used by horses and people at farm

General Description: spring flows directly into a barrel and is used by livestock.

PHYSICAL CHARACTERISTICS

Temperature (°C): 12.0°C.

Volume (l/min): small

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: cloudy, rusty, with algae, bubbling gas and a pleasant soda taste

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: none

Exceptional Features:

SPRING #:57

NAME: CLEARWATER

GENERAL

Location: 17km north of entrance to Wells Gray Park at tourist attraction known as Ray's Farm

Ownership: Wells Gray Provincial Park

Access: road/trail

Human Impact: near Ray's Farm - tourist attraction

General Description: 2 springs - one has formed a small calcareous volcano-shaped well (1m high x 3m wide)

PHYSICAL CHARACTERISTICS

Temperature (°C): 9°C.

Volume (l/min): 13 l/min

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: soda smell and taste

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

No wildlife usage recorded

Exceptional Features:

REFERENCES: MacDonald et al (1978)

SPRING #:58

NAME: WILLIAMS LAKE SPRING

GENERAL

Location: Cariboo Highway, south of Williams Lake. Follow the dirt road that proceeds west from Mile 141 on the Cariboo Highway.

Ownership: privately owned

Access: dirt road

Human Impact: no data

General Description: one cool mineral spring depositing tufa on slope - second one is a seep depositing tufa. An elongated tufa deposit about 25m long occurs at the largest spring.

PHYSICAL CHARACTERISTICS

Temperature (°C): 12°C

Volume (l/min): small

Total dissolved Solids (ppm): no data

pH: 6.52

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: cloudy, soda smell and taste; gas discharge giving a boiling effect

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

No wildlife usage recorded

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: 2 mi. below mouth of Coal River, B.C. Bank of Liard River.

Elevation 1550'

Ownership: proposed as an Ecological Reserve Access: road, foot

Human Impact: minimal disturbance

General Description: silurian dolomite - six small flows from solution channels in dolomite on bank of Liard River. - small tufa mounds, rifled terraces of travertine.

PHYSICAL CHARACTERISTICS

Temperature (°C): 48° C

Volume (l/min): 20-40 l/min.

Total dissolved Solids (ppm): 814

Chemical Constituents (ppm): Ca(125), K(34), Mg(77), Fe(1), Na(41), Mn(608), HCO₃(725), SO₄(77), F(.33), Cl(64), Si(40)

Gaseous Constituents (ppm): no data

General Character of Water: calcium bicarbonate type, relatively low mineral content
Clear, odourless, sporadic bubbling

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: very little vegetation surrounds the springs. Floristic diversity is low. The upland vegetation is mature and consists of large spruce trees.

No wildlife observations have been recorded.

Exceptional Features:

GENERAL

Location: 2 km. n.w. of bridge on Alaska Highway, B.C.

Ownership: Liard Hot Springs Provincial Park Access: Alaska Highway

Human Impact: used for bathing but not commercially developed

General Description: six main pools enclosed by small terraces of calcereous tufa - lush vegetation known locally as "Tropical Valley".

PHYSICAL CHARACTERISTICS

Temperature (°C): 54° C

Volume (l/min): large and variable, estimates range
2580 to 2940 l/min.

Total dissolved Solids (ppm): 1195

Chemical Constituents (ppm): Cl(23), SiO₂(57), CaO(292), MgO(68), SO₃(505)

Gaseous Constituents (ppm): CO₂

General Character of Water: calcium sulphate type - clear, pronounced sulphur odour. Pale grey-white algae growing in vent of large pool.

Exceptional Features: the tufa deposits near the springs are reported to emit low level radiation.

BIOLOGICAL CHARACTERISTICS

Flora: extremely lush vegetation with a great number of species and a large diversity of plant communities. Many species are out of their range and are present because of the thermal influence. Reid(1976) identified 14 such species. In addition, Ceska(1980) recorded the only known occurrence in B.C. of Utricularia ochroleuca.

Fauna: A total of 135 species have been recorded. The lake chub (Coverius plumbeus) inhabit several of the outlet areas.

Exceptional Features: the small warm-water snail (Physca spp?) is endangered and is only known to occur in Liard River Hot Springs.

REFERENCES: Waring(1965); Brandon(1965); Forslid(1961); Pavlick (1974); B.C. Hydro (1980); Crandall et al (1977); Ceska (1980); Reid (1976)

GENERAL

Location: 10 km upstream from confluence with Liard River on the left hand of the Deer River.

Ownership: Crown Land

Access: Trail or helicopter

Human Impact: none

General Description: the main springs consists of a large pool 30m in diameter and 6m deep with a discharge channel flowing across a flat tufa terrace to the Deer River where a 5m waterfall occurs. Numerous small springs to the southeast form another creek which flows east to the river.

PHYSICAL CHARACTERISTICS

Temperature (°C): 32°C.

Volume (l/min.): 4400 l/min (combined)

Total dissolved Solids (ppm): 340

pH: 7.9

Chemical Constituents (ppm): Ca(72), Mg(20), Na(4), K(2), Cl(4), SO₄(100), HCO₃(219)

Gaseous Constituents (ppm):

General Character of Water: the water is a calcium bicarbonate type with a distinct sulfur odor.

Exceptional Features: exceptional travertine cliffs up to 7 m in height covering area of approximately 0.5 ha.

BIOLOGICAL CHARACTERISTICS

Flora: a recent fire (1971) burned the entire area of the thermal spring and surrounding area. However, the vegetation in the vicinity of the thermal pools, islands and discharge channels hosts a variety of interesting plants common in thermal spring habitats. Mimulus guttatus, Parnassia palustris and Erigeron philadelphicus are common.

Fauna: In July 1979 an attempt was made to find Liard Phyxa. This species was not located but Phyxa lordi was. This is the most northerly known observation of this species.

Exceptional Features:

GENERAL

Location: located halfway down Crooked Lake on the south shore. Crooked Lake lies just north of the Smith River airfield.

Ownership: Crown Land

Access: road/boat or trail

Human Impact: none

General Description: the springs consist of two pools. The upper part (about 5m in diameter) drains into the lower pool (about 8m in diameter) which drains directly into Crooked Lake. Both pools are deep, the upper being at least 5m.

PHYSICAL CHARACTERISTICS

Temperature (°C): 19-26°C.

Volume (l/min.): no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: water very brown and muddy. Algae floating on pool surface.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the springs occur in a mature white spruce forest. Mimulus guttatus, Erigeron philadelphicus and Parnassia palustris are present in a small area. A rich bloom of aquatic plants occurs where the outlet discharges into the lake.

Fauna: no wildlife usage recorded.

Exceptional Features:

GENERAL

Location: located 97 km upstream of where the Alaska Highway crosses the Coal River.

Latitude: 60° 09' 08" N. Longitude: 127° 25' 02" W.

Ownership: Crown Land (now subject to reserve status). Access: helicopter.

Human Impact: none

General Description: there are several seeps originating from a mile-long linear escarpment. All seeps drain south by way of a series of sedge-willow meadows. The most southerly seeps have formed spectacular travertine terraces. The largest pool is 5 to 10m in diameter. Spring temperatures are cool (13°C) in comparison to other springs.

PHYSICAL CHARACTERISTICS

Temperature (°C): 13°C.

Volume (l/min.): 2700 l/min.

Total dissolved Solids (ppm): 325

pH: 7.48

Chemical Constituents (ppm): SiO₂(34), Na(1), K(1), Ca(76), Mg(16), HCO₃(175), SO₄(23)

Gaseous Constituents (ppm):

General Character of Water: calcium bicarbonate type; clear, odorless and tasteless

Exceptional Features: spectacular travertine terraces with concave terrace walls.

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation associations are not unusual for the boreal forest environment. The springs, because of their low temperature, seem to have little effect on the microclimate. Consequently, few species survive outside their normal range. The most interesting plant is Poa amphibia which was only previously known at the mouth of the MacKenzie River. Mimulus guttatus, Platanthera dilatata and Parnassia palustris dominate the hot spring terraces and are generally considered characteristic of hot spring environments. Velvet green mosses are also characteristic.

No exceptional wildlife species were recorded.

Exceptional Features:

GENERAL

Location: no specific location known

Ownership:

Human Impact:

General Description: Hot springs are rumoured to exist somewhere near Watson Lake but no record has been found of an actual visit (P. St. Pierre, pers. comm.)

PHYSICAL CHARACTERISTICS

Temperature (°C):

Total dissolved Solids (ppm):

Chemical Constituents (ppm):

Gaseous Constituents (ppm):

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora:

Exceptional Features:

GENERAL

Location: hot springs are shown at the 3500 ft. contours of the Otter creek watershed on map 95D of the Land Use Information Series maps - about 84 km 60°E of true north from Watson Lake Wye.

Ownership: territory

Human Impact: no data

General Description: M. Dennington, OWS Whitehorse (pers. Comm.) reported that he flew over this area to locate the spring, but could not identify it.

PHYSICAL CHARACTERISTICS

Temperature (°C):

Total dissolved Solids (ppm):

Chemical Constituents (ppm):

Gaseous Constituents (ppm):

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora:

Exceptional Features:

GENERAL

Location: 352 km north of Watson Lake, on southwest side of Flat River above 1km southeast of the town of Tungsten.

Ownership: Crown Land

Access: road

Human Impact: the spring was covered with fill when constructing the airstrip. The spring flow is now directed into a bathing pool.

General Description: spring issues from base of slope composed of tertiary granite pluton bedrock.

PHYSICAL CHARACTERISTICS

Temperature (°C): 41° C.

Volume (l/min): 60 l/min

Total dissolved Solids (ppm):

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: H₂S

Exceptional Features: clear with a slight sulfur odor

BIOLOGICAL CHARACTERISTICS

Flora: destroyed

Fauna: none

Exceptional Features:

GENERAL

Location: 30 km north of Whitehorse and then 10 km west of the Dawson City road; 3 km north of the Takhini River.

Ownership: Private, but used publicly Access: road

Human Impact: cribbed wall built around natural pool; water piped to swimming pool and old greenhouse.

General Description: the spring rises from limestone and greywacke into a natural pool that has been cribbed.

PHYSICAL CHARACTERISTICS

Temperature (°C): 47° C.

Volume (l/min): 200 l/min

Total dissolved Solids (ppm):

pH: 7.5

Chemical Constituents (ppm): Ca(586), Mg(95), Na(30), K(7.7), HCO₃(132), Sulphate (1721), Cl(1.5), F(4.4), Na₃(7.6), SiO₂(41)

Gaseous Constituents (ppm):

General Character of Water: the water is of a calcium sulphate type and has a slight sulfur odor. Brown algae is growing on the sides of the well.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no detailed description of flora but it is suspected that development has destroyed any of the interesting plant communities.

Fauna: no wildlife usage recorded

Exceptional Features:

REFERENCES: MacDonald et al(1978), Souther and Halstead (1973); Brandon (1965)

GENERAL

Location: north of Pelly Crossing, Yukon east of the Dempster Highway in the upper reaches of Hotsprings Creek.

Ownership: Crown Land

Access: helicopter from Mayo.

Human Impact: none

General Description: the springs occur along Hotsprings Creek and consist of a group of three springs on the southeast bank and one 200m upstream on the opposite bank. Flows are from shale intruded by granite. The oxidation of pyritiferous slates generate heat for the spring water.

PHYSICAL CHARACTERISTICS

Temperature (°C): 54°C.

Volume (l/min): 1800 l/min.

Total dissolved Solids (ppm): 177

pH: 9.5

Chemical Constituents (ppm): Ca(10), Mg(5), Na(50), SO₄(50), Cl(2)
F(4.4), Na₃(7.6), SiO₂(41)

Gaseous Constituents (ppm):

General Character of Water: sodium sulphate type with a very low mineral content. Slight sulfur odor.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Fauna: no wildlife usage recorded

Exceptional Features:

REFERENCES: MacDonald et al (1978), Brandon (1965)

GENERAL

Location: no specific location given. The general location is given as "to the east of a creek that flows north to join the South Nahanni River.

Ownership: Crown Land

Access: helicopter

Human Impact: none

General Description: 2 springs and a few seeps form a noticeable outwash devoid of trees about 60m wide. There are small travertine accumulations 6m by 20m several meters below the hottest vent.

PHYSICAL CHARACTERISTICS

Temperature (°C): 58°C.

Volume (l/min): 900 l/min.

Total dissolved Solids (ppm):no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear, pronounced sulfur odour in vent area. Dark to yellow green and orange to rust algae in outlets.

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: no detailed flora descriptions. It has been reported that wild mint, ferns and flowers abound in the vicinity of the springs. It can be expected the typical thermal spring vegetation probably grows around this spring.

Fauna: no wildlife usage recorded

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: small creek southeast of Broken Skull River

Ownership: Crown Land

Access: helicopter

Human Impact: none

General Description: the spring issues from two vents; the cooler one in a small pool at the base of a slope on the western bank of a creek flowing southeast into the Broken Skull River, and the hotter at the edge of the tufa that encloses the pool. Terraced tufa deposits are present.

PHYSICAL CHARACTERISTICS

Temperature (°C): 45°C. and 38°C.

Volume (l/min): 2100 l/min.

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: murky grey; bubbles (probably CO₂) are present in the pool

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: no data exists but the location, size of the tufa deposits and spring temperature indicates that significant thermal spring vegetation types would exist.

Fauna: no wildlife usage recorded

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: above creek which drains east and southwest into South Nahanni River. No exact location available.

Ownership: Crown Land

Access: helicopter

Human Impact: none

General Description: 3 springs flow down steep granite slope and into the South Nahanni River.

PHYSICAL CHARACTERISTICS

Temperature (°C): 64°C.

Volume (l/min): 3600 l/min.

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear, slight sulfur odour, green, orange, cream algae in outwash on the granite boulders.

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: no detailed vegetation data.

Fauna: no wildlife usage recorded

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: Junction of Buhl and Skookumchuck Creeks

Ownership: Crown Land

Access: road, often inaccessible because of
bridge washouts

Human Impact: none

General Description: a very small spring with warm temperatures, little information exists on this
spring.

PHYSICAL CHARACTERISTICS

Temperature (°C): warm

Volume (l/min): small

Total dissolved Solids (ppm):no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water:

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Fauna: no data

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: 4 km above the confluence of Ram Creek and the Lussler River

Ownership: Crown Land

Access: logging road

Human Impact: small pool built; some old pipes present

General Description: the springs issue from a number of outlets on the north side of Ram Creek along the base of a wall of massive dolomitic limestone (Jubilee Formation). Some travertine is slowly being deposited below the spring outlets.

PHYSICAL CHARACTERISTICS

Temperature (°C): 34.6°C

Volume (l/min): 185 l/min

Total dissolved Solids (ppm):225

pH: 7.6

Chemical Constituents (ppm): Ca(50), Mg(15), Na(2.6), K(1.3), HCO₃(155), SO₄(57), Cl(1.7), SiO₂(21)

Gaseous Constituents (ppm):

General Character of Water: the spring water is low in minerals and non-sulphurous. The water is a calcium bicarbonate sulphate type.

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: the area in the immediate vicinity of the springs has been disturbed by development and now a dense thicket of poison ivy (Rhus radicans var. rydbergii) grows all around the spring.

Fauna: no wildlife usage known

Exceptional Features:

REFERENCES: van Everdingen (1972); MacDonald et al (1978)

SPRING #:73

NAME: LUSSIER RIVER

GENERAL

Location: bank of Lussier River, 6.5 km south of Canal Flats, follow the White Swan Lake road to Mile 11.5; then follow short trail to Lussier River and springs.

Ownership: Crown Land

Access: road/short trail

Human Impact: log pool and bathhouse - a popular hot spring

General Description: three springs issue from broken limestone talus slope. Debris from the road has been pushed into one of the springs. Two outlets feed the log pool while the third feeds the small bathhouse. The discharge flows directly into the Lussier River.

PHYSICAL CHARACTERISTICS

Temperature (°C): 43.4°C

Volume (l/min): 220 l/min

Total dissolved Solids (ppm):2708

pH: 7.10

Chemical Constituents (ppm): Ca(145), Sr(1), Mg(25), Na(875), K(10), HCO₃(218), SO₄(105), Cl(1402), SiO₂(36), H₂S, CO₂

Gaseous Constituents (ppm):

General Character of Water: the water is highly mineralized and of a sodium chloride type.

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation has been destroyed by development

Fauna: no wildlife usage known

Exceptional Features:

REFERENCES: van Everdingen (1972); MacDonald et al(1978)

GENERAL

Location: 27 km east of Fort Steele on Wild Horse River

Ownership: Crown Land

Access: road

Human Impact: logged around the springs

General Description: one warm, three cold springs, extensive tufa deposits

PHYSICAL CHARACTERISTICS

Temperature (°C): 28.5°C and 12.5°C. Volume (l/min): 44 l/min

Total dissolved Solids (ppm): no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear, odorless, tasteless, no gas discharge

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the area surrounding the springs has been logged and is quite desolate. However, the extensive travertine deposits could contain unique hot springs vegetation communities. No detailed vegetation studies have been conducted.

no wildlife usage recorded

Exceptional Features:

GENERAL

Location: 28 km from Invermere

Ownership: Crown Land

Access: road

Human Impact: none

General Description: springs at mouth of canyon, 2 springs depositing tufa on hillside, 3 springs in creek bed and flooded during part of year.

PHYSICAL CHARACTERISTICS

Temperature (°C): 11.0°C

Volume (l/min): small, variable

Total dissolved Solids (ppm): no data

pH: 6.1

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: strong soda taste and smell, clear, gas discharge

Exceptional features: travertine deposits are present, one approximately 23m in diameter and another 4.5 m.

BIOLOGICAL CHARACTERISTICS

Flora: no data

Fauna: no data

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: west bank of Kootenay River, 15 km northwest of Canal Flats

Ownership: Crown Land

Access: boat

Human Impact: none

General Description: a warm spring issuing from the river gravels. The spring is flooded for most of the year. There are large travertine deposits along the riverbank.

PHYSICAL CHARACTERISTICS

Temperature (°C): warm

Volume (l/min): small

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water:

Exceptional features: travertine contains petrified leaves and grasses

BIOLOGICAL CHARACTERISTICS

Flora: no data but area usually flooded by river and no vegetation is expected, although adjacent tufa deposits could support unique vegetation

Fauna: no wildlife usage known

Exceptional Features:

REFERENCES: MacDonald et al (1978); van Everdingen (1972)

GENERAL

Location: east shore of Columbia Lake, 25 km north of Canal Flats

Ownership: Crown Land

Access: road

Human Impact: road cuts through the travertine deposits

General Description: large tufa deposits seal off old springs, very small, warm seeps

PHYSICAL CHARACTERISTICS

Temperature (°C): warm

Volume (l/min): small

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: no data

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: no detail data. Since no true thermal spring flow is present, no typical or unique thermal spring vegetation is expected.

Fauna: no wildlife usage known

Exceptional Features:

REFERENCES: MacDonald et al (1978); Souther and Halstead (1973); Waring (1965)

GENERAL

Location: located 3.2 km northeast of Columbia Lake and 1.6 km from Hwy. 93 on the Columbia River

Ownership: Private Resort

Access: road

Human Impact: tourist and health resort

General Description: a large group of thermal springs (7) many in their natural state. One group is located on a hill overlooking the resort. This hill is covered with up to 2m of travertine. The springs on the top of the hill dry up during the summer months as the "reservoir" level drops. A second group of springs is used by the resort.

PHYSICAL CHARACTERISTICS

Temperature (°C): variable and ranges
from 32.0°-48.9°C.

Volume (l/min): 2270 l/min (combined)

Total dissolved Solids (ppm): 1983

pH: 6.0 - 7.0

Chemical Constituents (ppm): Ca(430), Sr(3.6), Mg(113), Na(32), K(5.9), HCO₃(713), SO₄(984),
Cl(33), SiO₂(31)

Gaseous Constituents (ppm): CO₂

General Character of Water: clear, odorless and tasteless and of a calcium sulphate type; strongly radioactive (3180 units).

Exceptional features: large areas of travertine

BIOLOGICAL CHARACTERISTICS

Flora:

Fauna: no wildlife usage known

Exceptional Features:

REFERENCES: Van Everdingen(1972)

GENERAL

Location: Banff-Radium Highway 27 km south of Eisenhower Junction, north side of Vermillion R.

Ownership: Kootenay National Park

Access: highway

Human Impact: previously mined for the iron oxide and sent to Calgary for paint

General Description: the main active springs consist of three large pools although many smaller seeps are present. Rimmed with iron oxide deposits. When the water pressure can not overcome the height of the built-up rim, a "dead" cone occurs and the water must find an alternate outlet. This outlet then begins to build up an iron oxide rim. Calcium sulphate crystals occur along the discharge channels due to precipitation and evaporation. The discharge outlet into the Vermillion River has red stained the rocks of the river.

PHYSICAL CHARACTERISTICS

Temperature (°C): 10.7°C.

Volume (l/min): combined 330 l/min.

Total dissolved Solids (ppm):1739

pH: 3.7

Chemical Constituents (ppm): Ca(137), Mg(61.9), Fe(300), Al(5), Zn(52), Na(1.8), K(1), HCO₃(351), SO₄(1167), SiO₂(16.7)

Gaseous Constituents (ppm):

General Character of Water: clear, odorless and tasteless with a high heavy metal and sulphate concentration.

Exceptional features: colorful red-brown bogs known as "Ochre Beds". Indians reportedly used the ochre for paints.

BIOLOGICAL CHARACTERISTICS

Flora: the area is devoid of vegetation because of the very low pH. Mosses are reported to grow along the discharge channels.

Fauna: no wildlife usage recorded

Exceptional Features:

GENERAL

Location: Rocky Mountain Trench - Sinclair Creek valley 1.6km east of West Gate of Kootenay Park on Highway 93

Ownership: Kootenay National Park

Access: Radium-Banff Highway

Human Impact: tourist and health resort

General Description: the spring source is covered and the water piped to 2 pools

PHYSICAL CHARACTERISTICS

Temperature (°C): 43°C.

Volume (l/min): 1370 l/min

Total dissolved Solids (ppm): 696

pH: 7.4

Chemical Constituents (ppm): SO₄(306), HCO₃(216), Ca(140)

Gaseous Constituents (ppm): N₂, CO₂, CH₄, H₂S

General Character of Water: sulphated calcium bicarbonate type. Clear, odourless and tasteless

Exceptional features: strong radioactivity 4000 units, highest in Canada

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation has been destroyed by development

Exceptional Features:

REFERENCES: Elworthy(1926); Souther and Halstead(1973); MacDonald et al(1978)

GENERAL

Location: near the Aquacourt in Banff Springs village

Ownership: Banff National Park

Access:

Human Impact: Developed - best known spring in Canada

General Description: large cave about 12m in diameter and 6m high. Stalactites were once present but have been destroyed. The walls are coated with calcite and gypsum. CO₂ bubbles up through quicksand in the bottom of the pool where the spring emerges

PHYSICAL CHARACTERISTICS

Temperature (°C): 31.0°C.

Volume (l/min): 1136 l/min

Total dissolved Solids (ppm): 963

pH: 7.2

Chemical Constituents (ppm): Ca(222), Sr(1.7), Mg(42), Na(6.1), K(4.1), HCO₃(149), SO₄(582), Cl(5.1), SiO₂(27)

Gaseous Constituents (ppm): H₂S, CO₂

General Character of Water: calcium sulphate type

Exceptional features: large cave with pool in bottom

BIOLOGICAL CHARACTERISTICS

Flora: no vegetation is present in the cave, however, the thermal springs drains into a marsh before entering the Bow River. The drainage channel and marsh area are species rich and contain 13 species associated with thermal springs including 145 vascular plants. Yellow Lady's Slipper (Cypripedium passerinum) is one of the most outstanding characteristic species. In addition, 22 introduced species have been recorded, most notably Najas microdon and Vallisneria spiralis.

Fauna: the aquatic habitats that remain open during the winter provide important overwinter habitat for waterfowl and songbirds that would normally migrate south. Introduced tropical fish consisting of mosquitofish, sailfin molly and jewelfish are found in the cave and drainage channels. The Banff longnose dace is restricted to the marsh area. It has been recommended this species be given endangered status.

Exceptional Features: extremely species rich thermal marsh area with many characteristic thermal spring plants as well as rich wildlife habitats.

GENERAL

Location: located at 1584m on the northeast flank of Sulfur Mountain

Ownership: Banff National Park

Access: road and short trail

Human Impact: springs now covered and water pumped to bathhouse and swimming pool

General Description: the springs have now been developed to feed various bathing facilities

PHYSICAL CHARACTERISTICS

Temperature (°C): 47.3°C.

Volume (l/min): 545 l/min

Total dissolved Solids (ppm): 916

pH: 7.15

Chemical Constituents (ppm): Ca(224), Sr(1.6), Mg(37), Na(5.6), K(4.1), HCO₃(134), SO₄(545),
Cl(5.2), SiO₂(28)

Gaseous Constituents (ppm): H₂S, CO₂

General Character of Water: the water is a calcium sulphate type

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation has been destroyed by development

Fauna: no wildlife usage recorded

Exceptional Features:

REFERENCES: Van Everdingen (1972); Souther and Halstead(1973)

GENERAL

Location: northeast flank of Sulphur Mountain; follow trail off Mountain Ave. outside the Banff village

Ownership: Banff National Park

Access: road and short trail

Human Impact: largely in their natural state, although underground pipes feed a collecting basin.

General Description: there are three separate springs: one spring is located at the bottom of a pool inside a small cave; another issues from under rocks in front of this cave, and the last emerges from the bottom of a small solution cave. The area around the springs is covered with beds and banks of tufa.

PHYSICAL CHARACTERISTICS

Temperature (°C): 34.5°C. to 34.8°C.

Volume (l/min): 227 l/min

Total dissolved Solids (ppm): 1079

pH: 7.1

Chemical Constituents (ppm): Ca(250), Sr(1.9), Mg(45), Na(6.6), K(4.5), HCO₃(145), SO₄(664), Cl(5.5), SiO₂(31)

Gaseous Constituents (ppm): H₂S, CO₂

General Character of Water: a calcium sulphate type

Exceptional features: small solution caves

BIOLOGICAL CHARACTERISTICS

Flora: 193 species have been recorded consisting of 22 algae species, 11 liverwort species, 22 mosses, 35 lichens and 103 vascular plants. The most notable species are 8 orchid species. Many characteristic thermal springs plants such as Mimulus guttatus, Triglochin palustre, and Spiranthes romanzoffiana are found here.

Fauna: deer and other animals water here in the winter months

Exceptional Features: an outstanding example of typical thermal springs flora.

GENERAL

Location: located 183m down the slope from Upper Hot Springs

Ownership: Banff National Park

Access: road and trail

Human Impact: this spring is no longer in its natural state. A small concrete basin and pipes are present although no longer used.

General Description: water collected in small concrete basin. Outlet channel contains algae and sulphur bacteria. Calcite is present in the outlet channel.

PHYSICAL CHARACTERISTICS

Temperature (°C): 37.0°C.

Volume (l/min): 91 l/min

Total dissolved Solids (ppm): 874

pH: 7.05

Chemical Constituents (ppm): Ca(204), Sr(1.5), Mg(37), Na(5.4), K(3.8), HCO₃(143), SO₄(519), Cl(50), SiO₂(28)

Gaseous Constituents (ppm): H₂S, CO₂

General Character of Water: the water is a calcium sulphate type and is low in dissolved solids.

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: no data, but the vegetation is not expected to be exceptional because of past disturbances.

Fauna: no wildlife usage recorded

Exceptional Features:

GENERAL

Location: situated at the west end of the Aquacourt in the Banff village

Ownership: Banff National Park

Access:

Human Impact: completely altered by development

General Description: the spring rises in an artificial pool about 12.5 by 7.6 with a depth of 1.8 m. Outflows runs into small wading pool. Quicksand is present at the bottom of the artificial pool.

PHYSICAL CHARACTERISTICS

Temperature (°C): 34.2°C.

Volume (l/min): 68l l/min

Total dissolved Solids (ppm): 1677

pH: 7.1

Chemical Constituents (ppm): Ca(382), Mg(70), Na(6.6), K(6.2), HCO₃(146), SO₄(1102), Cl(4.8), F(1.2), SiO₂(31.5)

Gaseous Constituents (ppm): CO₂

General Character of Water: the water is a Calcium sulphate type and highly mineralized.

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: little vegetation is present where the spring rises, but the outlet channels flow into a marsh that is species rich and contains many characteristic thermal spring plant species similar to that described for Spring #80.

Fauna: tropical fish such as the mosquitofish (Gambusia affinis), sailfin molly (Poecilia latipinna) and Jewelfish (Hemichromis lineatus) are found in the Basin and outlet channels. The Banff longnose dace (Rhinichthys cataractae smithi) only is found in the thermal springs of the Cave and Basin drainage. Because of the abundance of marsh vegetation and its diversity as well as the warm spring waters that maintain areas of open water, many bird species, especially waterfowl, utilize the area yeararound.

Exceptional Features: exceptional display of thermal spring vegetation and unusual fish populations.

GENERAL

Location: Stoney Squaw Mountain, 4 km north of Banff near the Mt. Norquay Interchange

Ownership: Banff National Park

Access: Trans Canada Highway - Mt. Norquay Interchange

Human Impact: area disturbed by road construction

General Description: the spring emerges through rubble at ditch on side of Mt. Norquay turnout

PHYSICAL CHARACTERISTICS

Temperature (°C): 6.5°C.

Volume (l/min): very small

Total dissolved Solids (ppm): 584

pH: 7.35

Chemical Constituents (ppm): Ca(92.5), Mg(50), Na(31.8), K(2.5), HCO₃(318), SO₄(223), Cl(14.5),
SiO₂(13)

Gaseous Constituents (ppm): H₂S(12); CO₂(25)

General Character of Water: low mineralization as of a calcium bicarbonate type

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: area now hydroseeded and supports a grass and clover vegetation type

Fauna: no wildlife usage recorded

Exceptional Features:

GENERAL

Location: Vermillion Lake, 5 km northwest of Banff

Ownership: Banff National Park

Access: road (Vermillion Lakes Rd. - Banff-Lake Louise)

Human Impact: spring issues from under road, discharged into ditch, reaches lake via culvert

General Description: Upper Banff Limestone (Mississippian) outlets on both sides of road - flow into lake

PHYSICAL CHARACTERISTICS

Temperature (°C): 18.1° to 19.6°C.

Volume (l/min): 750 l/min

Total dissolved Solids (ppm): 434

pH: 8.2

Chemical Constituents (ppm): HCO₃(115), SO₄(147), Ca(95), Cl(42), Mg(23), Na(26), K(22),
SiO₂(9.6)

Gaseous Constituents (ppm): CO₂

General Character of Water: the water is a calcium sulphate type; faint H₂S odor; very low in TDS.

Exceptional features: spring flow keeps part of lake ice free - fish stay alive through winter

BIOLOGICAL CHARACTERISTICS

Flora: no vegetation is present or was destroyed by development

Fauna: Bighorn sheep use the ice-free area of the lake as a watering place; area exceptionally good bird watching area with many overwintering species because of the warm waters.

Exceptional Features: high diversity of marsh plants and bird species including waterfowl.

SPRING #:87

NAME: FORTYMILE CREEK

GENERAL

Location: bank of Fortymile Creek, 6.4 km n.w. of Banff, Bow River Valley.

Ownership: Banff National Park

Access: not known

Human Impact: recreational bathing

General Description: Van Everdingen (1972) could not locate the spring during the summer of 1969 and concluded it had dried up.

PHYSICAL CHARACTERISTICS

Temperature (°C): warm

Volume (l/min): small

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): CO₂, H₂S

General Character of Water:

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES: Van Everdingen (1972); Souther and Halstead (1973)

GENERAL

Location: foot of Turtle Mtn. south of Hwy 3, west of Frank, Alta.

Ownership: Crown Land

Access: trail

Human impact: water previously used in nearby sanitarium, however water generally too cold to be used without first heating it.

General Description: the springs emerge from bedrock at the base of the rocky slope of Turtle Mountain. The spring discharges into the Crowsnest River approximately 275m east of the springs. The rocks in the first part of the outlet are overgrown with yellowish filamentous algae. Farther down the channel the presence of suspended sulfur in the water imparts a greenish tint, which changes to a milky blue.

PHYSICAL CHARACTERISTICS

Temperature (°C): 9.0°C.

Volume (l/min): 454 l/min.

Total dissolved Solids (ppm): 748

pH: 7.1

Chemical Constituents (ppm): Ca(163), Sr(4.8), Mg(44), Na(6), K(2), HCO₃(182), SO₄(436), Cl(30), F(1)

Gaseous Constituents (ppm): H₂S(3)

General Character of Water: the water is a calcium sulphate type with a strong H₂S odor.

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: no vegetation data is available, but the low spring temperature and lack of a pool probably inhibits the development of characteristic thermal spring features

Exceptional Features:

GENERAL

Location: west flank of Fording Mtn. anticline between Fording Mtn. and Elk River, 16.5 km from where the eastside Freathy Road leaves Hwy. 3 at the north end of Natal.

Ownership: Crown Land

Access: logging road

Human Impact: diving board has been constructed

General Description: the spring issues from at least two places in the bottom of an elongated pool. Another spring bubbles to the surface in the second bend in the channel that carries overflow. A large lush meadow surrounds the pool. The underlying bedrock is a mixture of dolomite, shale, chert, conglomerate and sandstone.

PHYSICAL CHARACTERISTICS

Temperature (°C): 24.7° - 25.9°C.

Volume (l/min): 227-454 l/min.

Total dissolved Solids (ppm): 2661

pH: 7.10

Chemical Constituents (ppm): Ca(345), Sr(6.5), Mg(95), Na(344), K(16.8), HCO₃(207), SO₄(1430), Cl(305), SiO₂(16)

Gaseous Constituents (ppm): H₂S, CO₂

General Character of Water: calcium sulphate type with a very strong H₂S odor.

Exceptional features: one of the highest sulphate water contents found in the study.

BIOLOGICAL CHARACTERISTICS

Flora: no detailed data exists on the flora of the springs. However, its favorable temperatures and occurrence in a lush meadow environment would undoubtedly lead to the development of a flora characteristic to thermal spring environments as well as promote the development of a diverse flora in the surrounding meadow.

a variety of wildlife (moose, elk, deer) use the meadows adjacent to the springs.

Exceptional Features: lush, floristically diverse meadow surrounded by exceptional mountain scenery.

GENERAL

Location: 15.2 km south of Valemount along the Canoe River

Ownership: Crown Land

Access: forest road

Human Impact: small wood-cased hole for sitting

General Description: percolates at three points along shore of small lake at base of a steep mountain on the west side of a 1.6 km wide valley. A fourth spring occurs in logging slash 150m west of lake. The springs are very close to the Mica Reservoir (10m)

PHYSICAL CHARACTERISTICS

Temperature (°C): variable: 44 to 60°C. Volume (l/min):153 l/min.

Total dissolved Solids (ppm): no data pH: 7.8

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: clear, odorless, tasteless. One spring has slight sulphur taste and smell.

Exceptional features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

GENERAL

Location: located in a narrow part of the canyon of Sulphur Creek. A 18km road leaves Hwy. 16 at Pocahontas.

Ownership: Jasper National Park

Access: road

Human Impact: one spring developed by recreational bathing

General Description: three springs issue from jointed and fractured carbonate rocks of the Jubilee Formation along Sulphur Creek. One of the springs is below the Aquacourt and not accessible. The two remaining springs are located about 120 m upstream on the east and west sides of the creek. Travertine is being deposited around the outlets of these two springs as well as sulfur. Both springs discharge into Sulphur Creek. A boardwalk connects the two springs with the Aquacourt.

PHYSICAL CHARACTERISTICS

Temperature (°C): 47.3° to 53.9° C.

Volume (l/min): 795 l/min.

Total dissolved Solids (ppm): 1740

pH: 6.7

Chemical Constituents (ppm): Ca(407), Sr(13.7), Mg(56), Na(10.5), K(14.2), HCO₃(124), SO₄(1130), Cl(4.2), SiO₂(48)

Gaseous Constituents (ppm): H₂S, CO₂

General Character of Water: the water is highly mineralized and of a calcium sulphate type. A strong H₂S odor is present around the spring. Those springs have the highest calcium and one of the highest sulphate concentrations in the Rocky Mountains.

BIOLOGICAL CHARACTERISTICS

Flora: lush vegetation is present, but no exceptional species are known.

Exceptional Features:

GENERAL

Location: 1.6 km northeast of Athabaska R. bridge on Jasper-Edmonton Hwy. 16. Sign marks location.

Ownership: Jasper National Park, Alberta

Access: road/short trail

Human Impact: none

General Description: three sulphurous springs emerge from limestone and calcareous shales along a 1 km radius of the Athabaska River.

PHYSICAL CHARACTERISTICS

Temperature (°C): 7.5° to 9.0°C.

Volume (l/min): variable

Total dissolved Solids (ppm): 667

pH: 7.46

Chemical Constituents (ppm): Ca(98), Sr(2.4), Mg(34), Na(44.8), K(7.8), HCO₃(233), SO₄(188), Cl(59)

Gaseous Constituents (ppm): H₂S

General Character of Water: the cold water is a calcium bicarbonate type that varies seasonally in composition. Two of the springs have a strong H₂S odor.

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

GENERAL

Location: located 11 km north of the Jasper village on the Athabaska River

Ownership: Jasper National Park

Access: boat

Human Impact: none

General Description: the spring discharges at the base of a steep rock cliff which forms a canyon along the Athabaska River. The spring is covered by high water for most of the year and is only visible at low water periods.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data (>25°C)

Volume (l/min): no data

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water: no data

BIOLOGICAL CHARACTERISTICS

Flora: spring discharges at or below river level and has no vegetation.

Exceptional Features:

GENERAL

Location: located at the northeast corner of Williston Lake just west of Hudson Hope, B.C.

Ownership: Crown Land

Access: logging road

Human Impact: none

General Description: very little information exists on this thermal spring. Large tufa deposits are supposedly present and a pool along a small creek.

PHYSICAL CHARACTERISTICS

Temperature (°C): Hot (>32°C.)

Volume (l/min): large

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): CO₂

General Character of Water: no data

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

GENERAL

Location: Sikanni Chief River approximately 100km west of the Alaska Highway

Ownership: Crown Land

Access: helicopter

Human Impact: none

General Description: a series of springs flow from the base of a steep alluvial terrace. White travertine deposits have been built up along the river for a distance of 200 m. The distance between the river and the spring outlets is only about 20 m.

PHYSICAL CHARACTERISTICS

Temperature (°C): 12°C

Volume (l/min): small

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): H₂S

General Character of Water: warm spring with a strong H₂S odour

Exceptional Features: large travertine deposits flowing into the river.

BIOLOGICAL CHARACTERISTICS

Flora: Isolated clumps of Festuca altaica

wildlife use as a mineral lick

Exceptional Features:

GENERAL

Location: headwaters of Prophet River along the south bank

Ownership: Crown Land

Access: seasonal access by 4-wheel drive
vehicle

Human Impact: none

General Description: large deposits of calcareous tufa. Several springs. Very little information on this spring.

PHYSICAL CHARACTERISTICS

Temperature (°C): Hot (>32°C.)

Volume (l/min): small

Total dissolved Solids (ppm): no detailed data

Chemical Constituents (ppm): " " "

Gaseous Constituents (ppm): CO₂

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data but the vegetation is not expected to be altered significantly due to the small flows and discharge into the Prophet River.

Exceptional Features:

GENERAL

Location: 1 km above Junction with Racing River

Ownership: Muncho Lake Provincial Park

Access: aircraft; access by trail is possible
but requires fording of the Toad River which is difficult

Human Impact: None

General Description: a series of springs originate from the base of an alluvial terrace and cover an extensive muddy area next to the Toad River. No tufa is present although three sinter cones are present in the middle of the muddy area.

PHYSICAL CHARACTERISTICS

Temperature (°C): 47 °C.

Volume (l/min): no data

Total dissolved Solids (ppm): 790

pH: 7.2

Chemical Constituents (ppm): Ca(450); Cl(850) Data Incomplete

Gaseous Constituents (ppm):

General Character of Water: the waters are hot and odorless with CaSO_4 the main mineral constituent.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation of this hot spring is complex and floristically diverse and combines plants of several different types. The occurrence of Erigeron philadelphicus and Sphenopholis intermedia indicate the thermal springs influence.

Fauna: This area is an important mineral lick and is frequently used by moose.

Exceptional Features:

GENERAL

Location: 16km upstream of the Rapids of the Drowned on the Liard River

Ownership: Crown

Access: boat

Human Impact: none

General Description: Crandell(1979) reported that several springs were observed venting directly into the Liard River. They varied from seeps to active discharge which was depositing ochre and tufa.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data

Volume (l/min): no data

Total dissolved Solids (ppm):no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm):

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

GENERAL

Location: On the banks of Lepine Creek about 2000 m from its confluence with the Liard River.

Latitude: 59° 26' N

Longitude: 124° 50' W.

Ownership: Crown

Access: boat and foot

Human impact: none

General Description: the springs occur along the top of small anticlinal folds in the sedimentary rocks. Boulders in the stream bed below the spring are sulfur-coated.

PHYSICAL CHARACTERISTICS

Temperature (°C): warm

Volume (l/min): small

Total dissolved Solids (ppm): no detailed analysis of waters

Chemical Constituents (ppm): " " " "

Gaseous Constituents (ppm): CO₂, SO₂

General Character of Water: warm with a slight odor of H₂S

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data, but because of the warm nature of the water and small volumes, it is expected that the vegetation is not significantly altered. The surrounding vegetation has been burned by a recent forest fire.

Exceptional Features:

GENERAL

Location: 1175m from the confluence of the Sulfur Creek and Liard River.
Latitude: 59° 19' N Longitude: 125° 29' W.
Ownership: Crown Access: boat and foot

Human Impact: none

General Description: Crandall (1979) noted a 13°C seep on the left bank of Sulfur Creek. Upstream at distances of 1600 m and 1900 m on the left and right banks respectively are two cold springs (5%) marked by ochre and cream coloured riffle tufa terraces up to 5 m in height

PHYSICAL CHARACTERISTICS

Temperature (°C): 13 °C Volume (l/min): small

Total dissolved Solids (ppm): no data

Chemical Constituents (ppm): " "

Gaseous Constituents (ppm): " "

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the vegetation is not expected to be altered significantly because of the low water temperatures and low flows.

Exceptional Features:

GENERAL

Location: 6 km north of the Liard River on Brimstone Creek
Latitude: 59° 20' N Longitude: 125° 11' W
Ownership: Crown Access: boat/foot

Human Impact: none

General Description: very little data on this spring. Kindle (1944) reports: "Gas escaping from a spring a few feet from the east bank of Brimstone Creek, it is believed to be carbon and sulfur dioxide as it could not be ignited."

PHYSICAL CHARACTERISTICS

Temperature (°C): no data Volume (l/min): no data

Total dissolved Solids (ppm): no data

Chemical Constituents (ppm): " "

Gaseous Constituents (ppm): " "

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

GENERAL

Location: 2000 m from the confluence of Crusty Creek and the Liard River
Latitude: 59° 19' N Longitude: 125° 06' W
Ownership: Crown Access:boat and foot

Human Impact: none

General Description: the spring occurs along the top of an anticlinal fold in the sedimentary rocks.
Boulders in the streambed are sulfur-coated.

PHYSICAL CHARACTERISTICS

Temperature (°C): no data Volume (l/min): no data

Total dissolved Solids (ppm): no data

Chemical Constituents (ppm): " "

Gaseous Constituents (ppm): sulfur fumes were noted

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no detailed data; because of the relatively small size and flows, no significant vegetation differences are likely.

Exceptional Features:

GENERAL

Location: located on both banks of the Grayling River approximately 50 km from its confluence with the Liard River.

Ownership: Crown

Access: helicopter

Human Impact: none

General Description: a series of hot springs (7 on the left bank and 6 on the right bank) occur in a complicated pattern. These form many discharge channels into the Grayling River and extensive travertine deposits. The left bank spring has formed three large pools that are aquamarine in color. The discharge cascades to lower levels in a series of small waterfalls. The right bank springs flow from a 20m travertine terrace above the river, one large spring and pool are located on top of the terrace while the other springs pipe out along its base.

PHYSICAL CHARACTERISTICS

Temperature (°C): variable: 34 to 58°C. Volume (l/min): difficult to assess because of the number of outlets; estimated: 12,000 l/min.
Total dissolved Solids (ppm): 620 7.1

Chemical Constituents (ppm): Ca(110), Mg(25), K(6.6), Na(14), SO₄(290), Cl(13.9)

Gaseous Constituents (ppm):

General Character of Water: clear and tasteless with a strong H₂S odor.

Exceptional Features: spectacular travertine cliffs and blue pools surrounded by fragile travertine deposits.

BIOLOGICAL CHARACTERISTICS

Flora: the Grayling River hot springs were severely burned in a forest fire in 1971. Dead snags and young successional vegetation now cover the area surrounding the springs. Ceska (1980) considers the vegetation to be more diverse than any hot spring found in the Liard River Basin. This is due to the great number of habitats and large area influenced by hot water. A large number of interesting and unique plants occur.

Area used as a mineral lick

Exceptional Features: only known occurrence in Canada of Panicum thermale; extreme species richness.

GENERAL

Location: located on the south bank of the Beaver River just downstream from Pool Creek

Ownership: Crown Land

Access: helicopter

Human Impact: none

General Description: the spring flows from a small vent at the base of a tree-covered talus slope. It forms a small pool on the river terrace. Small tufa terraces are present.

PHYSICAL CHARACTERISTICS

Temperature (°C): 54.5°C.

Volume (l/min): 186 l/min.

Total dissolved Solids (ppm): no data

pH: no data

Chemical Constituents (ppm): no data

Gaseous Constituents (ppm): no data

General Character of Water:

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: because of its size the plant species diversity is low. Mosses and Mimulus guttatus are dominant species.

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: at the confluence of Larson Creek with the Beaver River

Ownership: Crown Land

Access: helicopter

Human Impact: none

General Description: the spring rises in a pool about 7 m in diameter and 3 m deep. An area of travertine covers an approximately 1000 meter square area. Another spring percolates from the gravel approximately 1 km downstream.

PHYSICAL CHARACTERISTICS

Temperature (°C): 43 °C and 53°C

Volume (l/min): 1800 and 2400 l/min.

Total dissolved Solids (ppm):

pH: no data

Chemical Constituents (ppm):

Gaseous Constituents (ppm):

General Character of Water: clear, odorless. Gas bubbling from bottom of pool.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data exists on the biological characteristics of this thermal spring. However, it is expected that, because of the available thermal spring habitat and warm spring water, typical hotspring flora would be present. It is not known whether any rare plants occur.

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: south bank of Rabbitkettle River, 2 km upstream from junction with S. Nahanni R.

Ownership: Nahanni National Park Access: helicopter

Human Impact: none

General Description: a spectacular series of terraced pools on a circular mound - stalactite flowstone deposits on sides of terraces; two smaller springs present.

PHYSICAL CHARACTERISTICS

Temperature (°C): 22 °C. Volume (l/min): approx. 500 l/min. combined

Total dissolved Solids (ppm): 1110 pH: 6.61

Chemical Constituents (ppm): Ca(218), Mg(34), HCO₃(802), SO₄(33), Na(4), K(5), SiO₂(13)

Gaseous Constituents (ppm): CO₂

General Character of Water: clear, odorless, orange algae on outflow terraces; calcium bicarbonate type

Exceptional Features: spectacular, terraced, flat-topped travertine mound 75 m in diameter and 25 m in height with 10 m pool at top.

BIOLOGICAL CHARACTERISTICS

Flora: Marsh and Scotter (1973) defined 6 vegetation types growing on odd travertine mounds and active hot spring mounds. Cody and Brigham (1972) recorded 27 species on the hot spring mounds. No rare species were recorded although many of the species are only found on the hot spring environments. Algae inhabit the tepid spring water.

Exceptional Features: none

REFERENCES: Van Everdingen (1973; Gabrielse et al (1965); Marsh and Scotter (1976); Cody and Brigham (1972)

GENERAL

Location: located on the right bank of the South Nahanni River 1.6 km upstream from Clausen Creek.

Ownership: Nahanni National Park Access: boat or helicopter

Human Impact: a pool and dam has been built to extend a natural pool.

General Description: a group of seeps occur along a floodwater channel of the South Nahanni River, follows the edge of the right bank limestone rockwall 100 m from the river. The springs issue from alluvium below the rockwall. Two major sources are present. One emerges in a partly man-made pool about 10 m in diameter; the other has formed a depression about 2 m deep with a pool 3 m in diameter. Both pools discharge directly into the river.

PHYSICAL CHARACTERISTICS

Temperature (°C): 35° - 36.7°C. Volume (l/min): 1800 l/min.

Total dissolved Solids (ppm): 4666 pH: 7.3

Chemical Constituents (ppm): Ca(490), Mg(70), Na(872), K(92), HCO₃(337), SO₄(684), Cl(2094),
SiO₂(26)

Gaseous Constituents (ppm): H₂S

General Character of Water: the water is a sodium chloride type; a very strong H₂S odor.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no vegetation is present because of the active floodwater channel and coarse gravel substrate.

no wildlife usage recorded

Exceptional Features:

REFERENCES: Van Everdingen (1973); Brandon (1965); MacDonald et al (1978)
(1972)

GENERAL

Location: located on both banks of the South Nahanni River between Twisted Mountain and the Liard Range.

Ownership: Nahanni National Park Access: boat or helicopter

Human Impact: none

General Description: the springs are associated with partly carbonaceous sandstones and shales of the Mattison Formation. No other information is available.

PHYSICAL CHARACTERISTICS

Temperature (°C): 8.2°C. Volume (l/min): small

Total dissolved Solids (ppm): 758.7 pH: 4.6

Chemical Constituents (ppm): Ca(48), Mg(55), Na(15), K(2.5), Fe(42), Mn(2.2), SO₄(556), Cl(7.3), SiO₂(30)

Gaseous Constituents (ppm): 4.6

General Character of Water: reddish brown iron hydroxide is being precipitated. Waters definitely not suitable for public use.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: the springs occur in boggy areas that are devoid of vegetation because of the low pH and toxic redox potentials.

Exceptional Features:

REFERENCES: Van Everdingen (1973)

GENERAL

Location: south side of creek draining into Flat River, 11.3 km east-northeast of Seaplane Lake

Ownership: Nahanni National Park

Access: helicopter

Human Impact: none

General Description: three pools mark the spring locations: an upper pool about 70 m by 30 m with an average depth of 2.5 m; a middle pool between 17 m and 40 m wide and an average depth of 2 m; a lower pool about 33 m by 12 m with an average depth of 1.5 m. They are dammed by oxate deposits of travertine that has a concave appearance.

PHYSICAL CHARACTERISTICS

Temperature (°C): 18°C - 26°C

Volume (l/min): 1800 l/min.

Total dissolved Solids (ppm): no data

Chemical Constituents (ppm): no data

Gas Constituents (ppm): no data

General Character of Water: clear, odorless, bubbling gas.

Exceptional Features: development of travertine wall that have concave shape.

BIOLOGICAL CHARACTERISTICS

Flora: no data exists on the flora of these springs. It has been reported that lush vegetation grows on the bottom of the pools.

Exceptional Features:

REFERENCES: Van Everdingen (1973); MacDonald et al (1978)

GENERAL

Location: located just west of Hole-in-the-Wall Lake

Ownership: Nahanni National Park Access: helicopter

Human Impact: none

General Description: 2 vent areas 300 m apart west of Hole-in-the Wall Lake; minor travertine deposits

PHYSICAL CHARACTERISTICS

Temperature (°C): 47°C

Volume (l/min): 1800 l/min.

Total dissolved Solids (ppm): no data

Chemical Constituents (ppm): no data

Gas Constituents (ppm): no data

General Character of Water: clear and odorless; green and pale orange algae are present.

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no vegetation data

Exceptional Features:

REFERENCES: Van Everdingen (1973); MacDonald et al (1978)

GENERAL

Location: southern bank of Godlin River upstream from mouth of Ekwi River, N.W.T.

Ownership: Crown Land

Access: helicopter

Human Impact: none

General Description: 3 vents - lowest and largest vent flows directly into river - small white stalactites on an overhang.

PHYSICAL CHARACTERISTICS

Temperature (°C): 46°C

Volume (l/min): 1800 l/min.

Total dissolved Solids (ppm): no data

Chemical Constituents (ppm): no data

Gas Constituents (ppm): no data

General Character of Water: clear with a salty taste. Ochre, red, green algae in overflow channel.

Exceptional Features: small stalactites on overhang above river.

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: 1 km south of South Redstone River on eastern slope of Rouge River, N.W.T.

Ownership: Crown Land

Access: helicopter

Human Impact: none

General Description: there are numerous vents with tufa deposits covering a 250 m by 300 m area. Several shallow pools present.

PHYSICAL CHARACTERISTICS

Temperature (°C): 54°C

Volume (l/min): 1200 l/min.

Total dissolved Solids (ppm): no data

Chemical Constituents (ppm): no data

Gas Constituents (ppm): no data

General Character of Water: clear, slight odor, gas bubbles (probably CO₂)

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data exists on the flora of these springs. Algae is present in the pools and outlet channels. It is expected that the presence of tufa and warm spring water would create habitats suitable for characteristic thermal spring vegetation to occur.

Exceptional Features:

REFERENCES: MacDonald et al (1978)

GENERAL

Location: 15 km up on southern bank of a small creek 3 1/2 km west of Grizzly Bear Lake, Yukon

Ownership: Crown Land

Access: helicopter

Human Impact: none

General Description: a series of four pools; one below another, lying 15 m up on the south bank of a small creek 3.5 km west of Grizzly Bear Lake.

PHYSICAL CHARACTERISTICS

Temperature (°C): 44.5°C

Volume (l/min): 180 l/min.

Total dissolved Solids (ppm): no data

Chemical Constituents (ppm): no data

Gas Constituents (ppm): no data

General Character of Water: clear, odorless, with green algae present

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data

Exceptional Features:

REFERENCES: MacDonald et al.(1978)

GENERAL

Location: east bank of MacKenzie River, 3.6 km north of Wrigley, N.W.T.

Ownership: Crown Land

Access: boat or helicopter

Human Impact: none

General Description: the springs issue from small rock fissures in Devonian limestone and shales in about 12 areas along a .5km linear bedrock escarpment. The spring waters seep out to form a small creek which flows into the MacKenzie River. No pools are present.

PHYSICAL CHARACTERISTICS

Temperature (°C): 25° - 32°C.

Volume (l/min): variable, 8-88 l/min.

Total dissolved Solids (ppm): 12556

pH: 7.7

Chemical Constituents (ppm): Ca(925), Mg(223), Na(3220), K(345), HCO₃(184), SO₄(2810), Cl(5226),
SiO₄(24)

Gas Constituents (ppm): H₂S

General Character of Water: clear with a strong H₂S odor; the waters are very saline (NaCl type) probably originating from a deep flow system in gypsum beds.

Exceptional Features: highest mineral content of any thermal spring in Canada.

BIOLOGICAL CHARACTERISTICS

Flora: the flora consists of a halophytic plant community composed of Scirpus rufus (dominant), Triglochin maritimum, Plantago eriopoda, Gentiana raupa, Glava maritime and Hordeum jubatum.

Exceptional Features:

REFERENCES: Souther and Halstead (1973); Brandon (1965), Lindsey (1953)

GENERAL

Location: mile 336, MacKenzie River, N.W.T.

Ownership: Crown Land

Access: boat or helicopter

Human Impact: none

General Description: the springs emerge from islands in the river, the principal flow is from a spring where water bubbles up into a small sandy pool surrounded by dense vegetation. The pool is shallow and limestone may be within 2 m of the surface. Several other seeps occur in a 100 m radius of this spring.

PHYSICAL CHARACTERISTICS

Temperature (°C): 13°C.

Volume (l/min): total - 4000 l/min

Total dissolved Solids (ppm): 1180

pH: 7.9

Chemical Constituents (ppm): Ca(250), Mg(64), Na(27.5), K(2), HCO₃(223), SO₄(683), Cl(37),
SiO₄(6.6)

Gas Constituents (ppm): H₂S

General Character of Water: clear of a calcium sulphate type

Exceptional Features:

BIOLOGICAL CHARACTERISTICS

Flora: no data exists on the flora

Exceptional Features:

REFERENCES: Souther and Halstead (1973); Brandon (1965)

APPENDIX C
LIST OF CONTACTS

LIST OF CONTACTS

1. J.G. Souther, Geological Survey of Canada, Vancouver, B.C.
2. D. Kielau, District Superintendent, Fish Creek Provincial Park, Alberta Parks and Recreation, Calgary, Alta.
3. Sheila Robinson, Cave and Basin Project, Parks Canada, Banff.
4. Eric Kuhn, Alberta Parks and Recreation, Calgary, Alta.
5. I. Jacks, Chief Interpreter, Kootenay National Park.
6. J. Todgham, Chief Interpreter, Jasper National Park.
7. J. Woods, Chief Interpreter, Glacier-Revelstoke National Parks.
8. J. Pojar, Ecologist, Ministry of Forests, Smithers, B.C.
9. Paul St. Pierre, Environmental and Socio-economic Services, B.C. Hydro, Vancouver, B.C.
10. A. Hodgeson, Dept. of Renewable Resources, Yukon Territorial Government, Whitehorse.
11. C. Tarnocai, Land Resource Research Institute, Agriculture Canada, Ottawa.
12. R. Heathman, B.C. Ministry of Parks and Recreation, Smithers, B.C.
13. Cyndi Smith, Interpretive Planning Assistant, Jasper National Park.